INDIA RUBBER WORLD

JANUARY, 1947

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DETROIT

STERLING NS

White sidewall tires are on the way back, and in Sterling NS Cabot has the right carbon black for the compound. Sterling NS is the result of a development program to find a new extract-free SRF* black suitable for white sidewall tires, door strips and all other purposes which require a non-staining black.

CABOT

*Semi-reinforcing Furnace Black.

GODFREY L. CABOT, INC., 77 FRANKLIN ST., BOSTON 10, MASS.

For Processing Safety...

USE THIONEX ACCELERATOR

TEST DATA

THIONEX ACCELERATED STOCKS

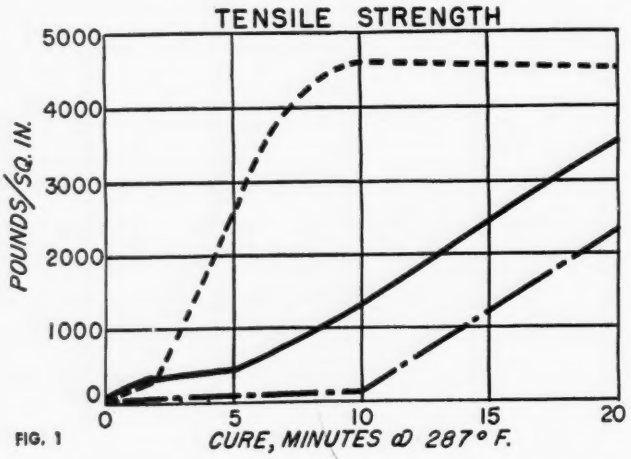


FIG. 1

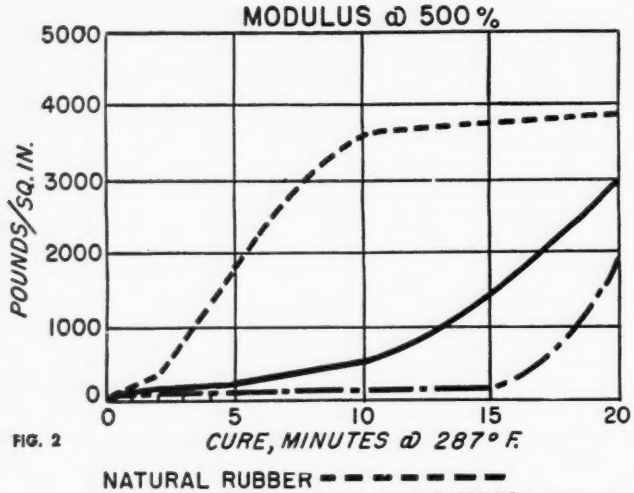


FIG. 2

NATURAL RUBBER - - - - - -
50-50 MIXTURE GRS & NAT. RUBBER ——
GRS — - — - —

Delayed Action at Curing Temperature Emphasizes Its Advantage In Rubber and GR-S Stocks

Thionex offers important advantages as an accelerator for natural rubber, GR-S and mixtures of these elastomers.

Outstanding property of Thionex is delayed acceleration . . . a timed action that starts only when the temperature of the stock reaches curing range. Test results show that on specimens cured at 287°F., Thionex does not begin to activate the cure for several minutes. But when the test pieces have been heated long enough to reach curing temperature, rate of cure is rapidly accelerated. These properties—delayed action and fast rate of cure—are graphically shown in Figures 1 and 2.

The delayed action of Thionex emphasizes its processing safety. Compounds may be exposed to temperatures approaching the curing range for short periods of time without danger of setting up during milling, calendering or extruding. And in the production of complicated molded goods, stocks accelerated with Thionex flow evenly—completely fill all sections of the mold before vulcanization begins.

That is why manufacturers have found Thionex so valuable in the production of wire insulation, molded goods, drug sundries, hose, heels and soles, tires and many other rubber products. Write us for detailed information on the use of Thionex in your products.

TABLE 1
Composition of stocks used in preparing test data

Stock No. 1527—	10	11	B12
Smoked Sheets	100.0	50.0	
GR-S		50.0	100.0
Zinc Oxide	5.0	5.0	5.0
Stearic Acid	1.0	1.0	1.0
Sulfur	2.0	2.0	2.0
EPC Carbon Black . . .	50.0	50.0	50.0
THIONEX	0.3	0.35	0.4

DU PONT RUBBER CHEMICALS

E. I. du Pont de Nemours & Co., (Inc.), Wilmington 98, Del.

BETTER THINGS FOR BETTER LIVING ...THROUGH CHEMISTRY

DU PONT

INDIA RUBBER WORLD, January, 1947, Vol. 115, No. 4. Published Monthly by BILL BROTHERS PUBLISHING CORP. Office of Publication, Orange, Conn., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U. S. A. Entered as Second-Class Matter at the Post Office at Orange, Conn., under the act of March 3, 1879. Subscription, United States and Mexico, $3.00 per Year; All Other Countries, $4.00; Single Copies 35 Cents. Address Mail to New York Office.

EXCELLENT AGE RESISTANCE

RESILIENT parts made from HYCAR American rubber resist the aging effects of air, sunlight, ozone, heat, cold, and all other types of oxidation. That's why they *stay* resilient—and stay on the job for a long, long time.

Other important properties of HYCAR American rubber are shown in the box at the right. And it's important to know that these properties may be had in an almost limitless number of combinations—each compounded to meet a given set of service conditions.

We make no finished products of HYCAR. But we urge you to ask your supplier for parts made from this versatile material. You'll learn for yourself that it's wise to use HYCAR—in difficult or routine applications—for long-time, dependable performance. For more information, please write Dept. HA-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. EXTREME OIL RESISTANCE — insuring dimensional stability of parts.
2. HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.
3. ABRASION RESISTANCE—50% greater than natural rubber.
4. MINIMUM COLD FLOW—even at elevated temperatures.
5. LOW TEMPERATURE FLEXIBILITY—down to —65° F.
6. LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.
7. AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.
8. HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.
9. NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)

Hycar
Reg. U. S. Pat. Off.
American Rubber

B. F. Goodrich Chemical Company
A DIVISION OF THE B. F. GOODRICH COMPANY

GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE brand chemicals

This advertisement appeared in a long list of carefully selected business papers TO HELP YOU SELL parts made from HYCAR.

REMOVE THE NERVE THE EASY WAY . . . USE PHILBLACK A!

There are certain problems every manufacturer of rubber products has to struggle with. "Removing the nerve" is one which Philblack A solves easily.

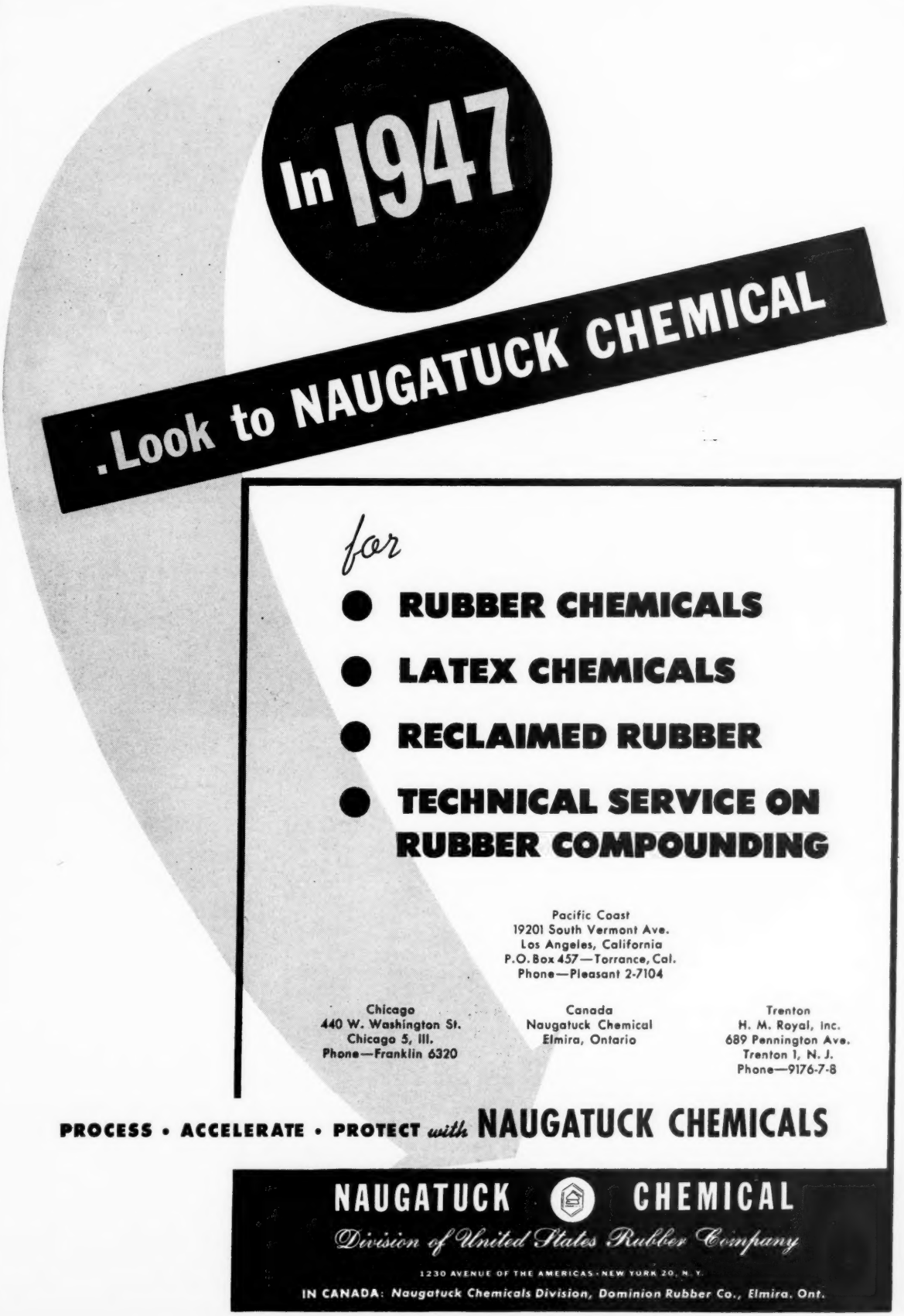
You know that Philblack A is the sure way to easier and faster processing . . . speeds up mixing cycles and lowers your processing time!

And, when you're thinking about the *finished* product, just consider the advantages Philblack A offers you . . . high hot tensile . . . good heat and electrical conductivity . . . excellent resistance to abrasion . . . and high resilience.

PHILLIPS PETROLEUM COMPANY

Philblack *Division*

EVANS SAVINGS AND LOAN BUILDING · AKRON 8, OHIO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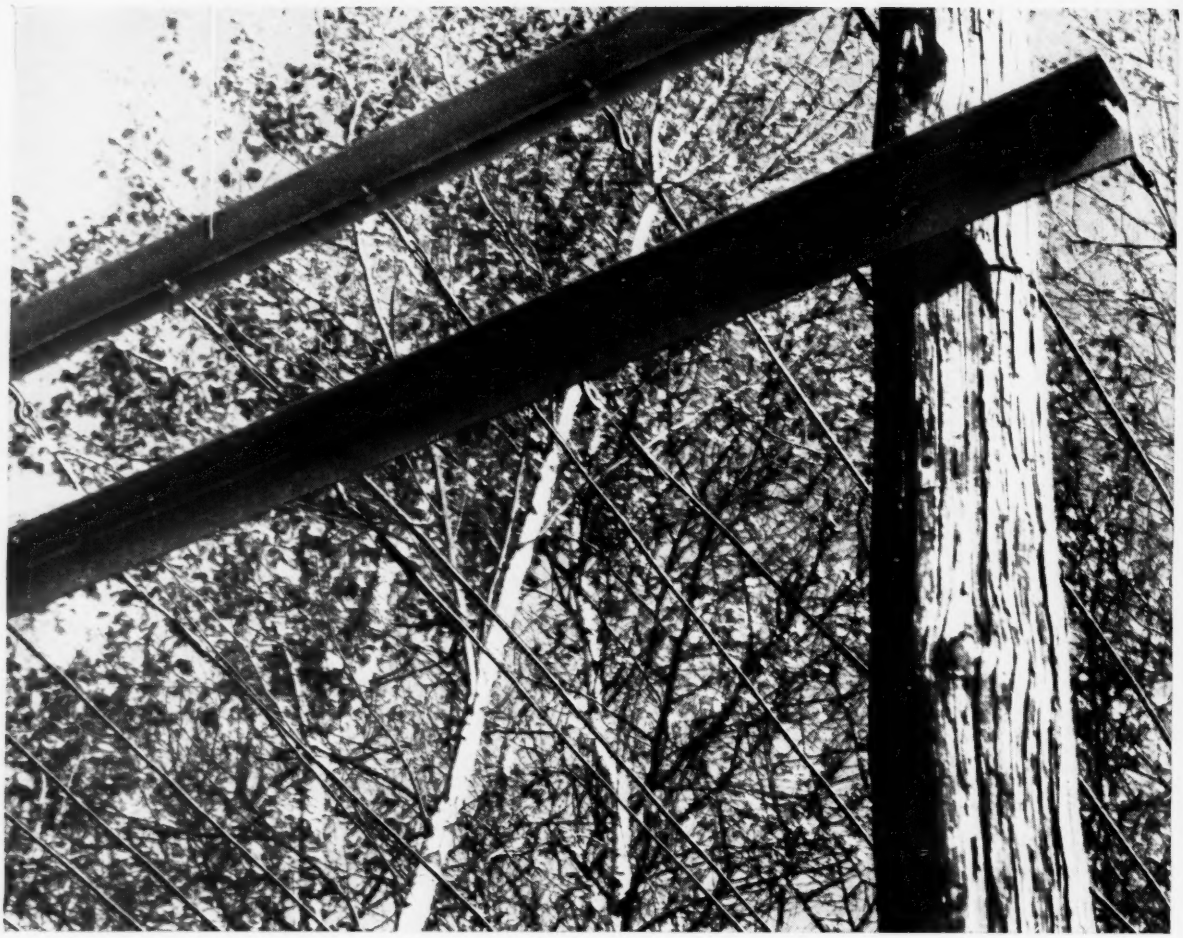


Drop-wire undergoing abrasion tests in birch thicket "laboratory." Below, the new drop-wire, now being installed.

WE'RE GLAD THAT BIRCH TREES SWAY

The telephone wire which runs from the pole in the street to your house is your vital link with the Bell System. More than 17,000,000 such wires are in use.

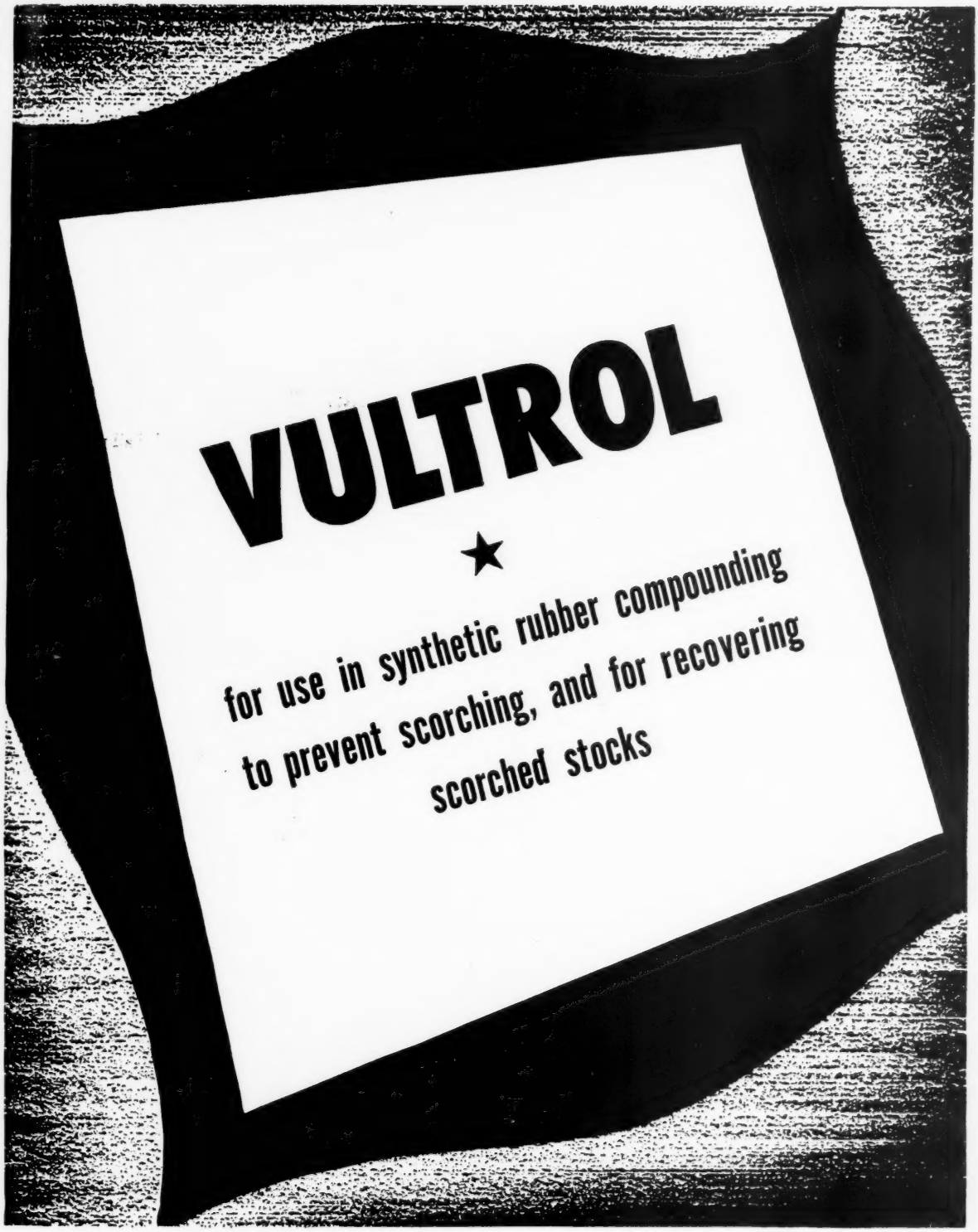
The wire becomes coated with ice; it is ripped by gales, baked by sun, tugged at by small boys' kite strings. Yet Bell Laboratories research on every material that goes into a drop-wire—metals, rubbers, cottons, chemicals—keeps it strong, cheap, and ready to face all weathers.

Now a new drop-wire has been developed by the Laboratories which lasts even longer and will give even better service. It has met many tests, over 6 or 7 years, in the laboratory and in field experiments. It has been strung through birch thickets—rubbed, winters and summers, against trees, and blown to and fro by winds. In such tests its tough cover lasts twice as long as that of previous wires.

House by house, country-wide, the new wire is going into use. Wire is only one of millions of parts in the Bell System. All are constantly under study by Bell Telephone Laboratories, the largest industrial laboratory in the world, to improve your telephone service.

BELL TELEPHONE LABORATORIES

EXPLORING, INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE



For technical data please write Dept. CA-1

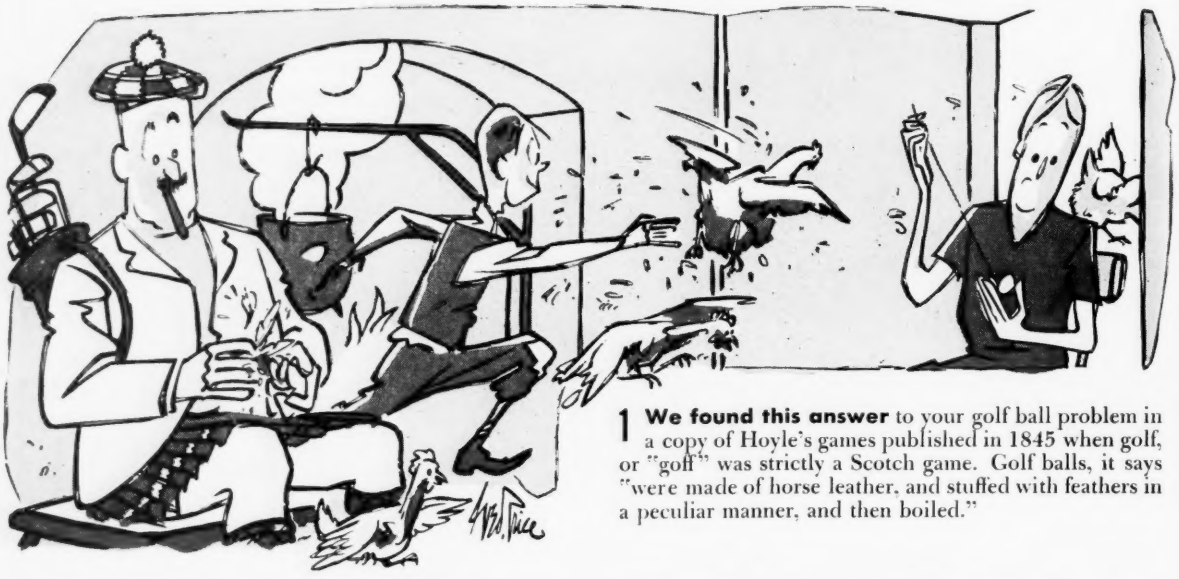
B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

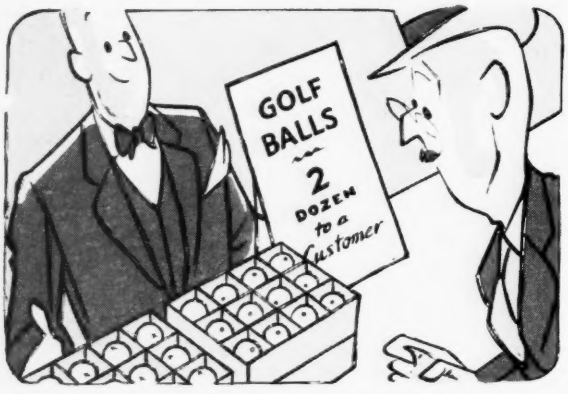
ROSE BUILDING, CLEVELAND 15, OHIO

How to make Golf Balls

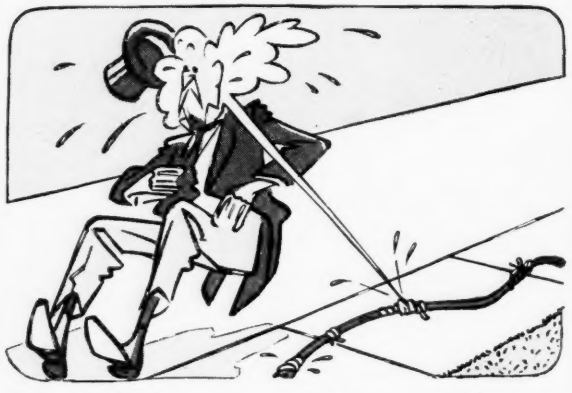
(ACCORDING TO HOYLE)



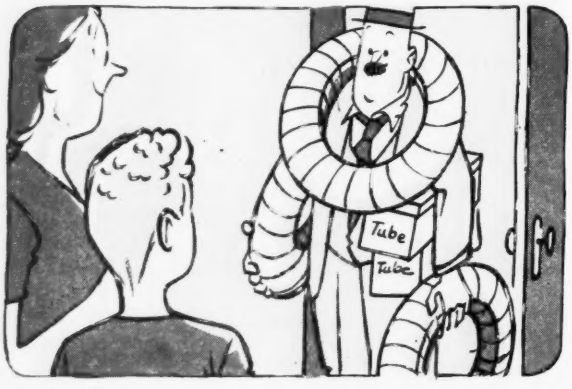
1 **We found this answer** to your golf ball problem in a copy of Hoyle's games published in 1845 when golf, or "goff" was strictly a Scotch game. Golf balls, it says "were made of horse leather, and stuffed with feathers in a peculiar manner, and then boiled."



2 **We want to help you** make golf balls in your *own* peculiar manner. We can give you a Taylor control setup to help cure the thread, help mold the cover, even help dry the paint. Ask your Taylor Field Engineer.



3 **In fact** Taylor Instruments help cut cost and improve quality of almost any rubber product. Garden hose, hot water bottles, sponge rubber cushions are made better and cheaper with Taylor Flex-O-Timers on the job.



4 **Taylor Accuracy** started improving tire production when the only instrumentation was a pressure gauge on a pot heater. Today we can offer you completely automatic control of your tire molding presses.

Taylor Instruments

MEAN

ACCURACY FIRST

IN HOME AND INDUSTRY

5 **Whatever your problem,** natural or synthetic, molding or vulcanizing, we think we can help you increase your efficiency. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

New data on Silene* EF

demonstrates use in a variety of GR:S Compounds

• Silene EF is a hydrated calcium silicate of extremely fine particle size. It imparts excellent tear and abrasion resistance—especially at high temperatures—good tensile and high hardness and stiffness. The compounder has great latitude in his choice of accelerator-plasticizer combination when using Silene EF.

* Trade-Mark Registered U. S. Patent Office

Silene EF has proved a highly effective reinforcing pigment in a wide variety of GR:S compounds. Data just compiled presents physical tests of miscellaneous formulations employing a number of accelerators and plasticizers. The compounder will find this information of value in the development of GR:S stocks which require the characteristics conferred by Silene EF. You are invited to write for Columbia Pigments Data Sheet No. 47-1.

COLUMBIA CHEMICALS
PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
FIFTH AVENUE at BELLEFIELD, PITTSBURGH 13, PENNA. • Chicago • Boston • St. Louis
Pittsburgh • New York • Cincinnati • Cleveland • Philadelphia • Minneapolis • Charlotte • San Francisco

COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS
Soda Ash · Caustic Soda · Liquid Chlorine · Sodium Bicarbonate · Pittchlor *(Calcium Hypochlorite)* · Silene EF *(Hydrated Calcium Silicate)* · Calcium Chloride · Soda Briquettes *(Iron Desulphurizer)* · Modified Sodas · Caustic Ash · Phosflake *(Bottle Washer)* · Calcene T *(Precipitated Calcium Carbonate)*

Recognized by the rubber industry as a primary source for scrap rubber, scientifically sorted and graded

Jack Sider • *J. K. McElligott*
PRESIDENT EXECUTIVE VICE-PRES.

Since 1868

The **LOEWENTHAL** *Co.*

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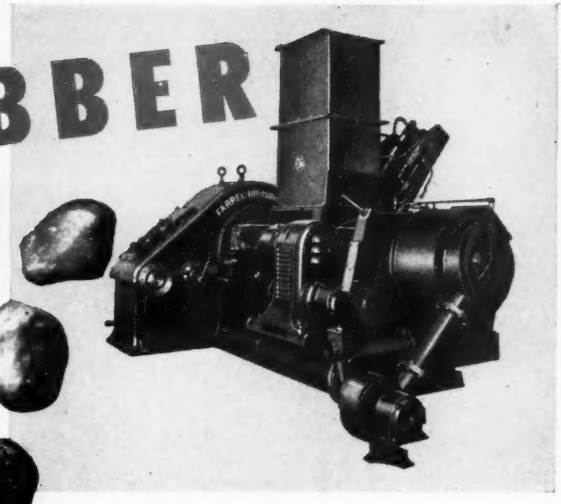
UNITED CARBON CO., INC.
Charleston W. Va.
NEW YORK · AKRON · CHICAGO

1947

Maintenance of high standards of quality and uniformity in carbon blacks, a continuous program of constructive research; all that can be done to aid those we serve.... These we will provide in the year ahead.

UNITED CARBON CO., INC.
Charleston, West Virginia

6 WAYS THAT PELLET RUBBER STEPS UP MILL ROOM EFFICIENCY



Here's a machine that, by transforming bulky, hard-to-handle rubber into small, free-flowing pellets, makes possible lower-cost, higher-efficiency mill-room layouts such as the one shown in the diagram.

Here are six processing advantages that you get from a pellet rubber system:

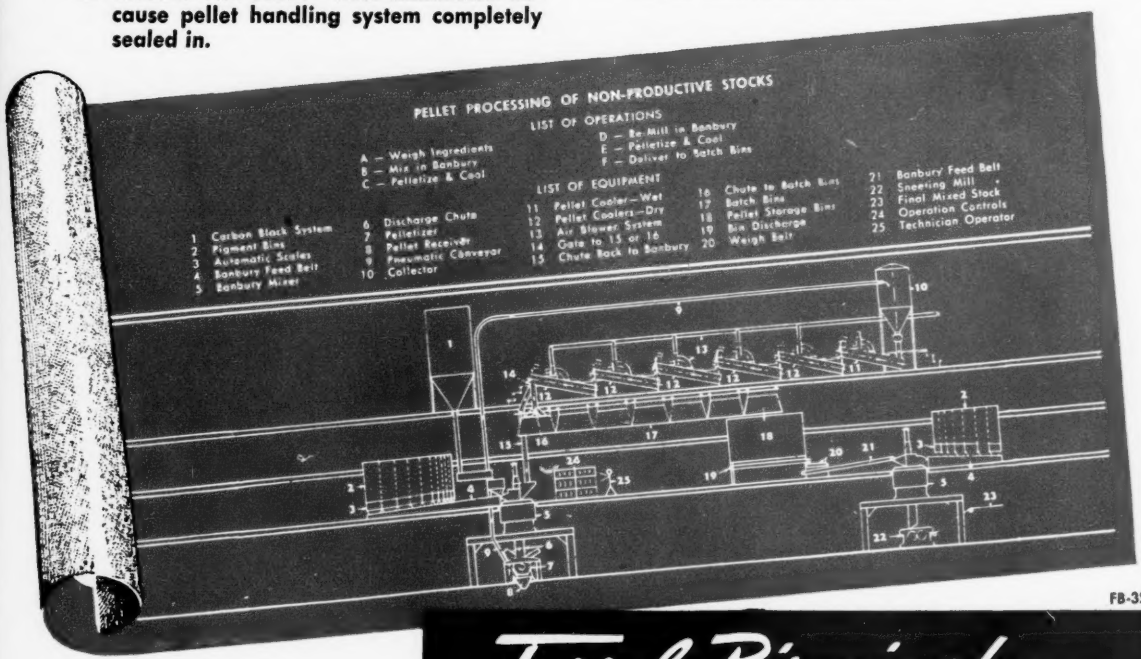
1. **Manual handling reduced by automatic conveying, weighing and mixing.**
2. **Increased production—Banbury mixing cycle reduced.**
3. **Greater ease of mixing and blending rubber pellets improves uniformity and quality of finished product.**
4. **Pellets thoroughly cooled more quickly—reduces time between processing operations—less stock in process.**
5. **Less floor space required — floor storage and trucking eliminated.**
6. **Cleaner mill room — dust eliminated because pellet handling system completely sealed in.**

The Hale Pelletizer itself is an extruding machine with a screw which forces the rubber up to the pelletizing head where the pellets are formed. These pellets are lightly coated with soapstone before leaving the machine to prevent sticking together.

You can get complete information and engineering help on the pelletizer and pellet rubber system by sending us a request on your letterhead. No obligation, of course.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: **Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.**
Sales Offices: **Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte**



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Farrel-Birmingham

IN WIND, RAIN, SNOW OR HAIL • YOUR FREIGHT GETS THERE BY UNION PACIFIC RAIL!

Facts Favor Your Future in the "Union Pacific West"*

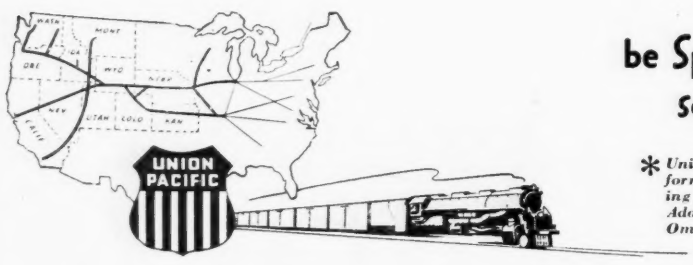
Of special interest to the Rubber Industry

Fact 1. Since V-J day, hundreds of industrial and commercial concerns have located factories, warehouses and distribution facilities on the Union Pacific right-of-way in the western states served by the railroad.

Fact 2. This vast territory is rich in raw materials, natural resources, skilled and unskilled workers... with ideal living conditions, good schools, and plenty of space for future expansion.

Fact 3. Travel surveys show vacationists favor the western area by a wide margin. Result—greater interest in the West leading to permanent residence... growing markets, more manpower for industry.

Fact 4. Over its Strategic Middle Route, uniting the East with the West Coast, Union Pacific provides unexcelled rail transportation.



be Specific – say "Union Pacific"

* *Union Pacific will gladly furnish confidential information regarding available industrial sites having trackage facilities in the territory it serves. Address Industrial Dept., Union Pacific Railroad, Omaha 2, Nebraska.*

UNION PACIFIC RAILROAD

The Strategic Middle Route

PHILLIPS RUBBER COMPOUNDING MATERIALS

low cost *high quality* *easily handled*

Phillips Rubber Compounding Materials are distinguished by low cost, high quality and ease of handling. Specifications, characteristics and their behavior in rubber are remarkably uniform. Three products of outstanding merit are:

PHILLIPS RECLAIMING RESIN NO. 1

PHILPLAST NO. 1

PHILPLAST NO. 2

Phillips Reclaiming Resin No. 1 is a free-flowing petroleum product recommended for digester reclaiming. The high penetrating characteristic of this material promotes the swelling of, and thus facilitates the conversion of scrap to a plastic state.

Philplast No. 1 is a petroleum-base product compatible with both natural and synthetic rubbers. Viscosity and pour point are low enough that it may be easily processed in the factory without pre-heating. Excellent aging characteristics, plasticizing action and no retardation of cure are typical advantages of Philplast No. 1.

Philplast No. 2 is a plasticizer-extender of unique chemical structure. Possessing a low viscosity and pour point, Philplast No. 2 exhibits a high compatibility with both natural and synthetic rubbers and is recommended where compounds with the following properties are desired:

LOW HYSTERESIS
GOOD ABRASION LEVEL CURING

A brochure containing complete technical data on Philplast is now available. A request on your letterhead will bring your copy.

PHILLIPS PETROLEUM COMPANY

Chemical Products Department

BARTLESVILLE, OKLAHOMA

NEOPRENE PLANT

LOUISVILLE • KENTUCKY

FOR SALE NOW.. in whole or in part

Units and equipment easily convertible to manufacture of other chemicals

● This plant consists of approximately 223 acres of land, with more than 30 buildings containing machinery and equipment designed to manufacture GR-M (Neoprene). It consists of 5 units with total capacity of 60,000 long tons of GR-M per annum.

EQUIPMENT: Production equipment includes cooling towers, condensers, pumps, compressors, pressure vessels, wood tanks, steel tanks, crushers, conveyers, steam turbines, dryers, refrigeration machines and other equipment, including instruments. Essential laboratory equipment is also included. Adequate storage for all raw material is provided in steel tankage.

UTILITIES: Electricity and gas furnished by local utility companies. Water is supplied by 18 wells located on plant site and by a river pumping station. Process and heating steam is provided by 3 combustion engineering, four-drum, bent tube boilers, each having normal rating of 180,000 lbs. of steam per hour, using pulverized coal for fuel. A water softening plant for boiler water is housed in power plant building. A stand-by agreement for furnishing steam in emergency is in effect with Louisville Gas and Electric Co. A complete drainage system for sanitary sewage and storm and process water is provided.

TRANSPORTATION: Plant is served by a spur track of the Kentucky and Indiana Terminal Railroad which connects to other railroad lines at Louisville. Water transportation is available through dock facilities at Louisville. Plant is connected by paved roads to arterial highways.

CREDIT TERMS MAY BE ARRANGED. Information contained herein is not intended as a basis for negotiations. The War Assets Administration reserves the right to reject any or all proposals.

Write or call for illustrated brochure. For information address all inquiries to:

GOVERNMENT OWNED SURPLUS PLANTS

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OFFICE OF REAL PROPERTY DISPOSAL

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"Flexol"
Trade-Mark
PLASTICIZERS

"Flexol" Plasticizers are designed to meet industry's expanding needs for products with good general characteristics such as compatibility and low volatility. In addition, each "Flexol" Plasticizer is outstanding in producing one or more special properties such as low-temperature flexibility, resilience, or high impact strength.

"Flexol" Plasticizers are successfully serving industry in lacquers, artificial leathers, vinyl films and sheetings, vinyl butyral safety glass, and molded and extruded products based on the vinyl resins and cellulose derivatives.

The "Flexol" Plasticizers shown are in commercial production. Several more are available in research or development quantities. Consult us on availability.

Our laboratories have prepared extensive data on the performance of the "Flexol" Plasticizers for many uses. This information will assist you in selecting the right "Flexol" Plasticizer or mixture of plasticizers for your needs.

COMPATIBILITY OF "FLEXOL" PLASTICIZERS (20% OF COMPOSITION) WITH VARIOUS RESINS

	DOP	3GH	3GO	4GO	TOF	B-400	8N8
Vinyl Acetate	I	C	SI	C	C	I	C
Vinyl Butyral	C-L	C	C-L	I	C	I	C
Vinyl Chloride	C	C	C	C	C	I	C
Vinyl Chloride-Acetate	C	C	C	C	C	I	C
Cellulose Acetate	I	I	I	I	SI	I	I
Cellulose Acetate-Butyrate	C	C	C	SI	SI	I	—
Cellulose Nitrate	C	C	C	C	C	C	C
Ethyl Cellulose	C	C	C	C	C	I	C
Synthetic Rubbers	C	C	C	C	C	I	C

C—Compatible I—Incompatible S—Slightly L—Plasticizer sweats out

A booklet on the general function of plasticizers and the specific uses of "FLEXOL" PLASTICIZERS, Form-5882, may be of help in your application. Phone or write our nearest office for this booklet or for samples and prices.

"Flexol" is a registered trade-mark of Carbide and Carbon Chemicals Corporation.

SYNTHETIC ORGANIC CHEMICALS

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

UCC

30 East 42nd Street, New York 17, N. Y. Offices in Principal Cities

Distributed in Canada by Carbide and Carbon Chemicals, Limited, Toronto

Technical Bulletin No. 29 — on the Compounding of GR-S with Substantial Loadings of Zinc Oxide

Rebound-Temperature Measurements

Goodyear-Healey Pendulum

GR-S—X-272, GR-S and GR-S-10

Time of Cure at 45 Lbs.	GR-S—X-272			GR-S			GR-S-10		
	Goodyear-Healy Pendulum			Goodyear-Healy Pendulum			Goodyear-Healy Pendulum		
	Block Temp. °C.	Indentation in mm.	Per Cent Rebound	Block Temp. °C.	Indentation in mm.	Per Cent Rebound	Block Temp. °C.	Indentation in mm.	Per Cent Rebound
90	0	6.01	42.3	0	6.73	46.7	0	6.01	35.6
	13.3	6.41	50.3	14.0	7.20	54.8	14.1	7.18	49.2
	18.9	6.71	53.9	21.1	7.47	58.0	19.6	7.18	52.8
	26.3	6.90	57.1	53.3	7.92	67.0	26.3	7.43	56.0
	51.1	7.30	63.8	87.7	8.21	71.6	57.5	8.02	62.8
	90.6	7.64	70.3	114.4	8.34	74.3	100.7	8.45	71.6
	114.6	7.77	74.0	134.3	8.42	75.7	125.0	8.53	74.6
	137.2	7.85	75.7	149.9	8.45	75.7	148.3	8.64	77.7
	160.3	7.92	78.1	174.5	8.57	75.7	168.3	8.78	79.8
	177.6	8.06	79.5	192.6	8.89	75.3	185.4	8.95	79.8
	194.0	8.30	80.2				192.2	9.14	79.8

(Refer to Technical Bulletins Nos. 20, 24 and 28)

X-272 has resilience properties close to GR-S in the temperature range 0-100°C. and follows the GR-S-10 curve closely in the range 100-194°C. The polymers with high Mooney Plasticity tend to have somewhat higher Rebounds.

COMPOUND No. 29

Polymer	100.0
Sulfur	3.0
"El-Sixty"	2.0
DPG	0.1
Coumarone-indene Resin	3.0
E.L.C. Magnesia	5.0
ZINC OXIDE	100.0

Uniform Quality **HORSE HEAD ZINC OXIDES**

THE NEW JERSEY ZINC COMPANY

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MODERN BUSINESS demands the employment of dependable specialists wherever and whenever possible.

Our customers' exacting needs have helped shape us into specialists in the art of getting the right materials to the right place on time...*what you need when you need it.*

It is this type of reliability, which only years of conscientious effort can truly develop, which characterizes the friendly customer-relationship that we have maintained for over 40 years.

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WAREHOUSES: Jersey City • Akron • Boston • Los Angeles • Memphis

From Tires for Motor Cars to Grips for Handle Bars

Dutch Boy: "It's true of almost every product . . . if it's made with rubber . . . *it's better made with Red Lead.*"

Plant Chemist: "Just why are you so sure?"

Dutch Boy: "First, experiments showed, then experience *proved*, that compounding rubber with #2 RM Red Lead gives the advantages listed on the right."

Plant Chemist: "But don't those advantages depend on what I make?"

Dutch Boy: "Yes, they do. You get all seven if you make tires; but *most* of them apply with other fields, too."

Plant Chemist: "But don't they depend on the base I use?"

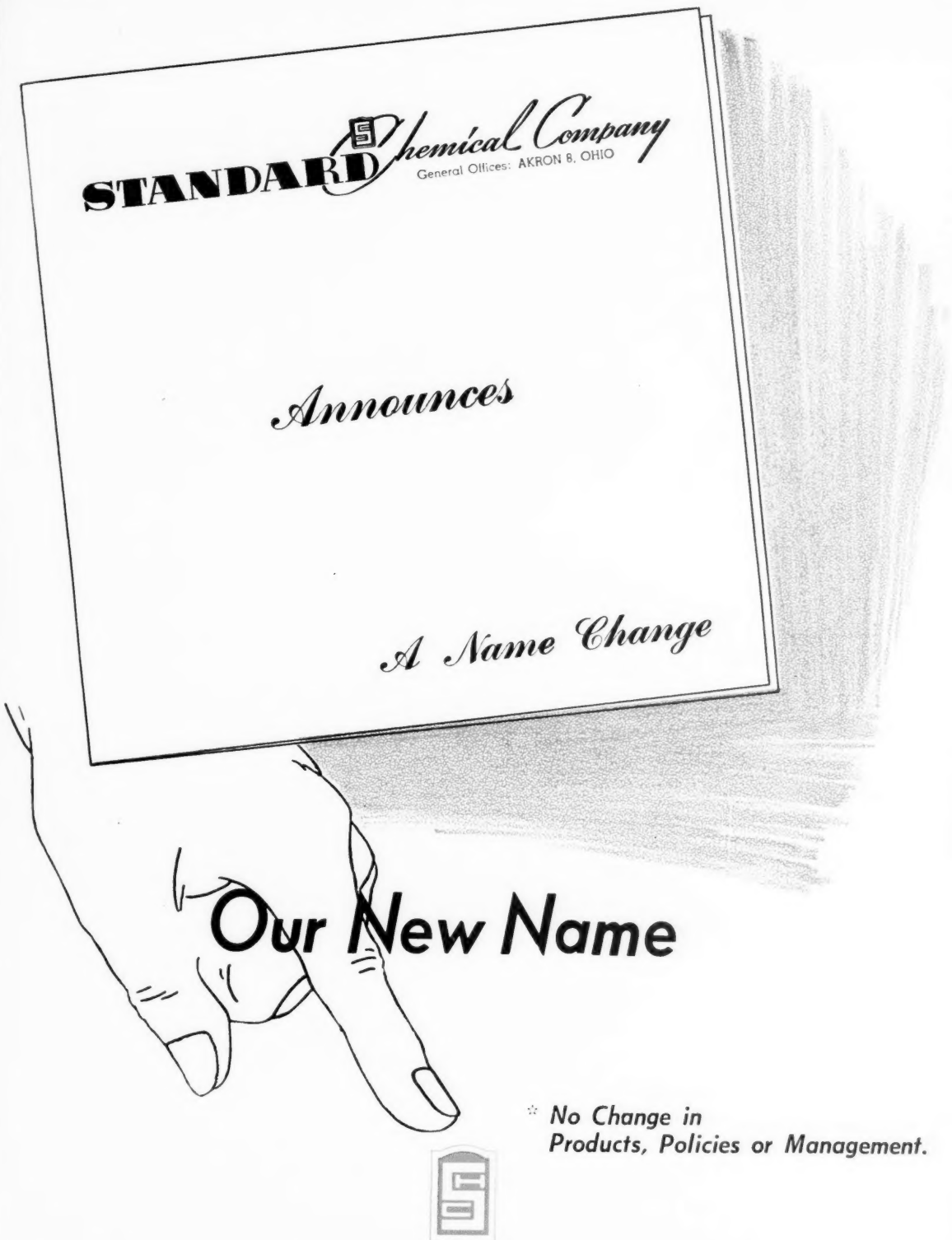
Dutch Boy: "They apply whether you work with GR-S, GR-S-10, GR-M, GR-A or GR-I. Just let us know your specific application, and our technical staff will gladly supply literature and any other information you need. Drop a line to the Rubber Division of our Research Laboratories, 105 York Street, Brooklyn 1, New York."

CHOOSE YOUR OWN Rx FOR COMPOUNDING WITH #2 RM RED LEAD

1. *Improved Heat Stability—Retention of Elasticity*
2. *Lower Heat Build-up—Cooler Running*
3. *Economical*
4. *Faster Curing Rate*
5. *Extended Curing Range*
6. *Excellent General Physical Properties*
7. *Safe Processing*

NATIONAL LEAD COMPANY—New York 6; Buffalo 3; Chicago 8; Cincinnati 3; Cleveland 13; St. Louis 1; San Francisco 10; Boston 6. (National Lead Co. of Mass.); Philadelphia 7. (John T. Lewis & Bros. Co.); Pittsburgh 30. (National Lead Co. of Pa.); Charleston 25, West Virginia. (Evans Lead Division).

If it's made with Rx RUBBER ... it's better made with RED LEAD



* *No Change in Products, Policies or Management.*

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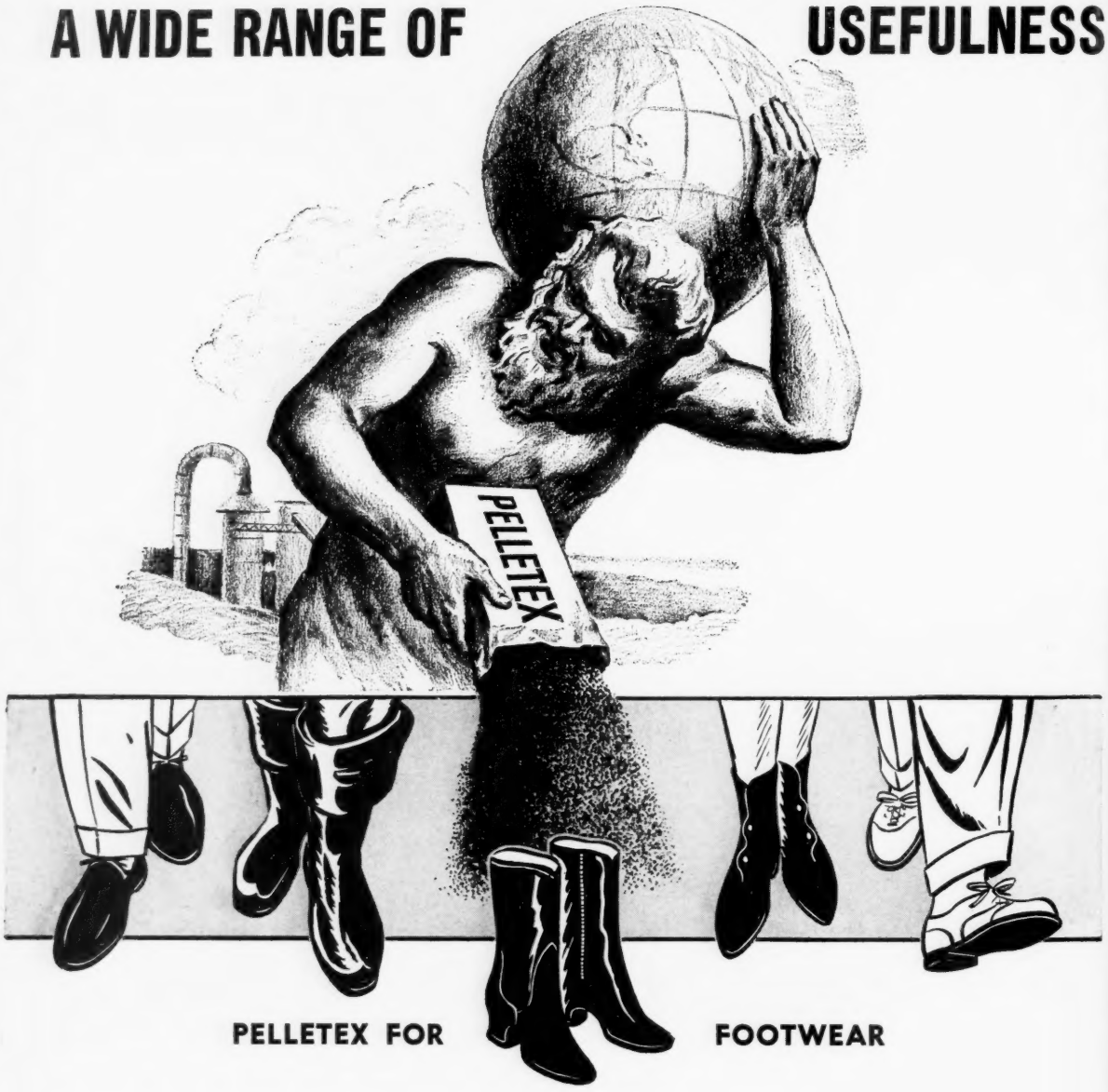
A WIDE RANGE OF USEFULNESS



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For longer wear and greater comfort in waterproof footwear PELLETEX S R F black in the compound has been found universally superior. Time tested for a decade it is the ideal black pigment for overshoes, boots, soles and heels.

Easy to process **Age resistant**
Low permanent set **Freedom from cracking**

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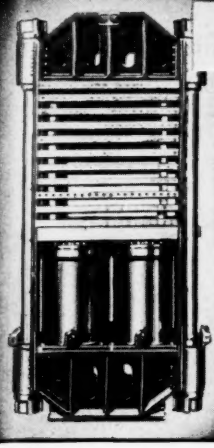
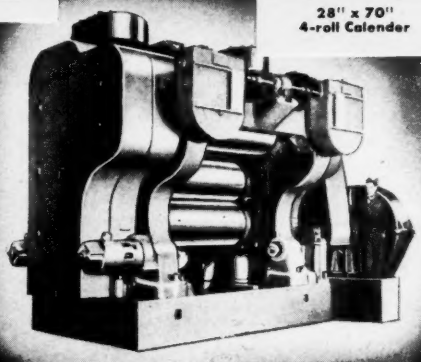
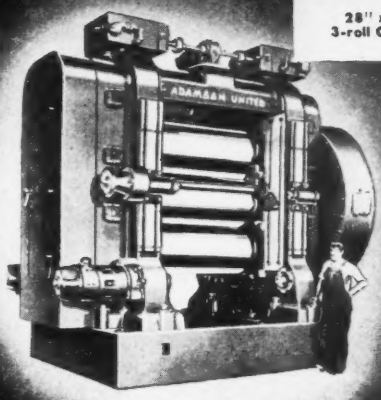


36" x 36" Platen Press



28" x 70" 4-roll Calender



28" x 70" 3-roll Calender

For Every Rubber Processing Purpose

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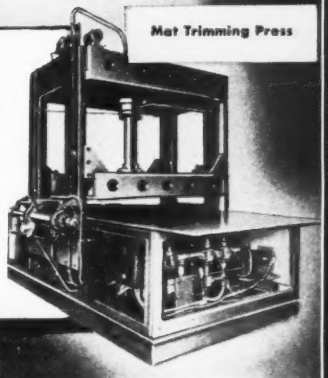


Mat Trimming Press

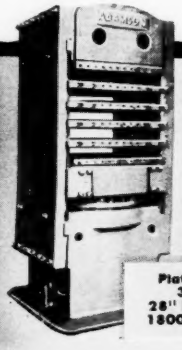
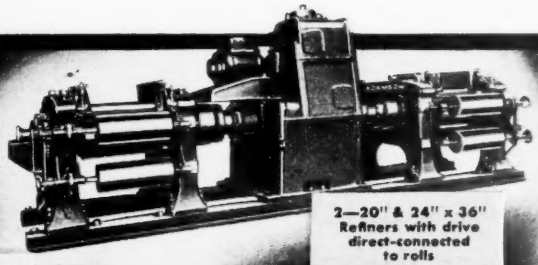
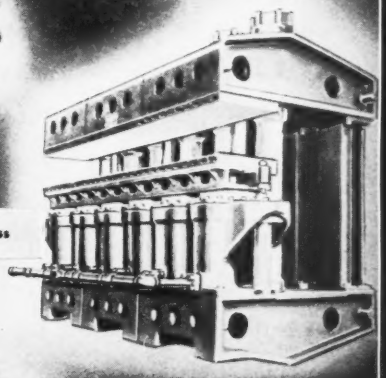


Plate Side Press 36" x 36" 28" Diameter Ram 1800 Lb. Hydraulic



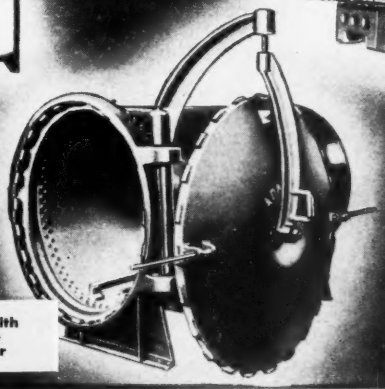
2—20" & 24" x 36" Refiners with drive direct-connected to rolls



Open side Press

Hydraulic operated Lift Tables

Fabric Festoon Storage Compensator



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Building machinery for conventional or special rubber processing requirements has been our business for half a century.

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The experience and abilities of our engineers are at your service.

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Brighten and whiten your rubber products with TITANOX. Unusually high whiteness and brightness are developed with these widely used titanium pigments because of their color, high refractive index, extremely fine particle size and ease of dispersion. Also, the clarity of tint of colored rubbers, an extremely desirable characteristic, is enhanced by the use of TITANOX.

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Our Technical Service Department is available, without obligation, for helping or advising you on your rubber pigmentation problems. Phone or write your nearest Titanium Pigment Corporation office today.

• Aerial view of the Titanium Pigment Corporation plant at Sayreville, New Jersey, one of the factories where TITANOX pigments are produced to the standards of unusually high quality that make them *preferred pigments.*

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NON-VOLATILE COMPATIBLE VERSATILE

GR-S CAMELBACK

FORMULA GR-S 100—EPC Black 50—Zinc oxide 5—INDONEX 639½ 10—Sulfur 2—Zenite B 1.75—Stearic acid 1—Thermoflex A 1.

PROPERTIES (50′ cure at 292°F.). Tensile 2245 (2250)*—Modulus 200% 290 (965)*—Elongation 835 (440)*—Hardness 50 (64)*—Tear 350 (340)*

*After aging 70 hours at 212°F.

PERBUNAN HARD RUBBER

FORMULA—Perbunan "26" 100—Sulfur 42—Extra light MgO 5—Calcene 50—INDONEX 639½ 10.

PROPERTIES—Tensile and Shore D Hardness (30′ at 325°F) 5200 and 75—(60′) 6750 and 85—(90′) 6800 and 86.

HIGH LOADING OF EPC BLACK IN NATURAL RUBBER

FORMULA—Smoked Sheets 100—EPC Black 100—INDONEX 639½ 35—ZnO 5—Stearic acid 1—Sulfur 3—Benzothiazyl disulfide 1—BLE Powder 1.

PROPERTIES (Avg. of 6 cures at 316°F.). Tensile 1912 (1182)*—Modulus 200% 417 (1002)*—Elongation 600 (250)*—Hardness 56 (74)*—Tear 315 (239).*

*After aging 70 hours at 212°F.

Send for Bulletins 13 and 13A

These bulletins describe typical tire, inner tube, and mechanical goods applications (with GR-S, natural rubber, Neoprene, Chemigum, Perbunan) including examples of unusual high-loaded low-cost GR-S and Neoprene compounds.

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CHEMICAL PRODUCTS DEPARTMENT
910 SOUTH MICHIGAN AVENUE CHICAGO 80, ILLINOIS

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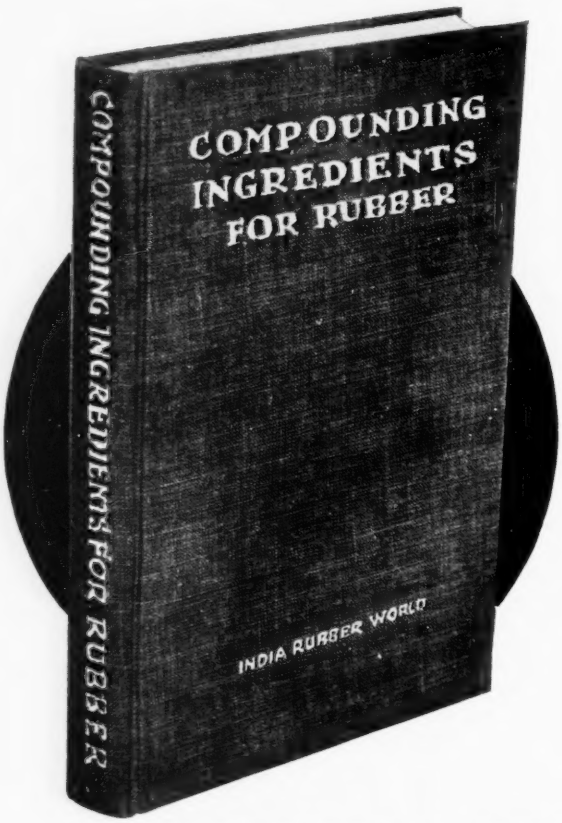

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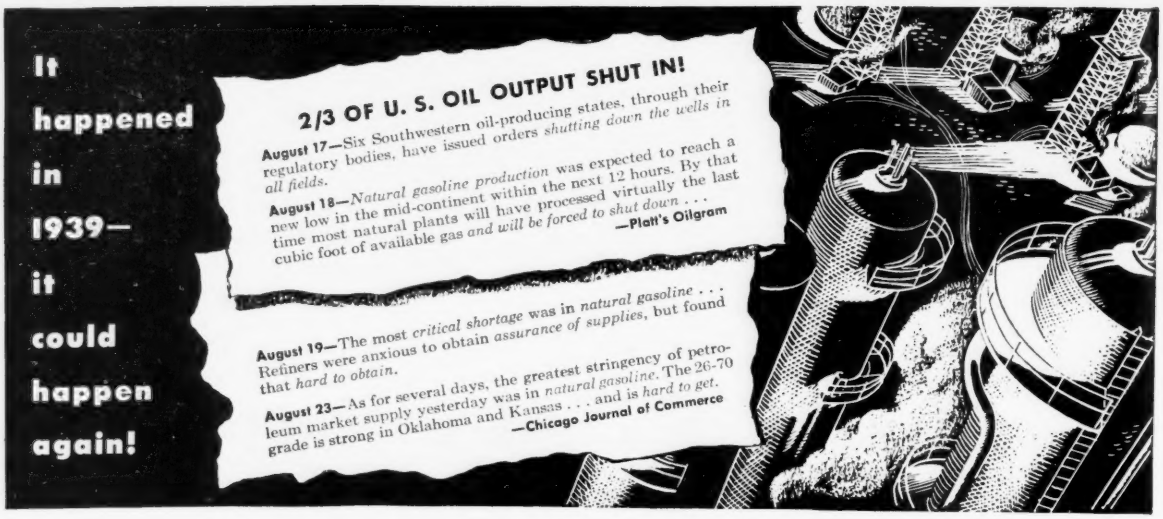
It happened in 1939— it could happen again!
2/3 OF U. S. OIL OUTPUT SHUT IN!
August 17—Six Southwestern oil-producing states, through their regulatory bodies, have issued orders shutting down the wells in all fields.
August 18—Natural gasoline production was expected to reach a new low in the mid-continent within the next 12 hours. By that time most natural plants will have processed virtually the last cubic foot of available gas and will be forced to shut down . . .
—Platt's Oilgram
August 19—The most critical shortage was in natural gasoline . . . Refiners were anxious to obtain assurance of supplies, but found that hard to obtain.
August 23—As for several days, the greatest stringency of petroleum market supply yesterday was in natural gasoline. The 26-70 grade is strong in Oklahoma and Kansas . . . and is hard to get.
—Chicago Journal of Commerce

A NATIONAL EMERGENCY PROVES SKELLYSOLVE'S FAMED

Dependability of Supply!

Two weeks' oil-field shutdown in six states creates critical shortage of natural gasoline . . . finds Skelly with ample reserves to go on producing and supplying special solvents for several weeks!

"DOC" MacGEE SAYS: When governing bodies in six oil-producing states issued orders in August, 1939, shutting down every oil field within their borders for a two weeks' period, the most critical of the resultant shortages was in *natural gasoline*. Produced mainly from natural gas coming from oil wells, natural gasoline is the raw material from which Skellysolve-B, Skellysolve-C, and similar special solvents are derived.

Few plants where these special solvents could be produced maintain sizable storage facilities for natural gasoline. This means that when oil production stops, production of special solvents could continue for only a very short time in those plants.

But not so at Skelly! For at our Lyman, Oklahoma, plant we have natural gasoline storage capacity of about 3,000,000 gallons! Throughout the two weeks' oil-field shutdown, we were able to continue making Skellysolve from our reserves of natural gasoline. All Skellysolve orders were shipped promptly upon receipt, in the usual Skelly custom. What's more, we could have gone on making Skellysolve for several weeks longer, had the shutdown continued!

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There are six different types of Skellysolve especially adapted to various uses in this industry, for making rubber cements and for many different rubber fabricating operations. Skellysolve offers many advantages over benzol, rubber solvent gasoline, toluol, carbon tetrachloride, etc. Our Skellysolve Technical Fieldmen have aided many manufacturers in developing formulas for new or improved products, and in "shooting" solvent troubles. Write today for full information.

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LOW ABRASION RESISTANCE
LOW TENSILE
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PROPERTIES VARY ALONG THIS LINE AS PARTICLE SIZE BECOMES SMALLER

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GREY—BLACK COLOR
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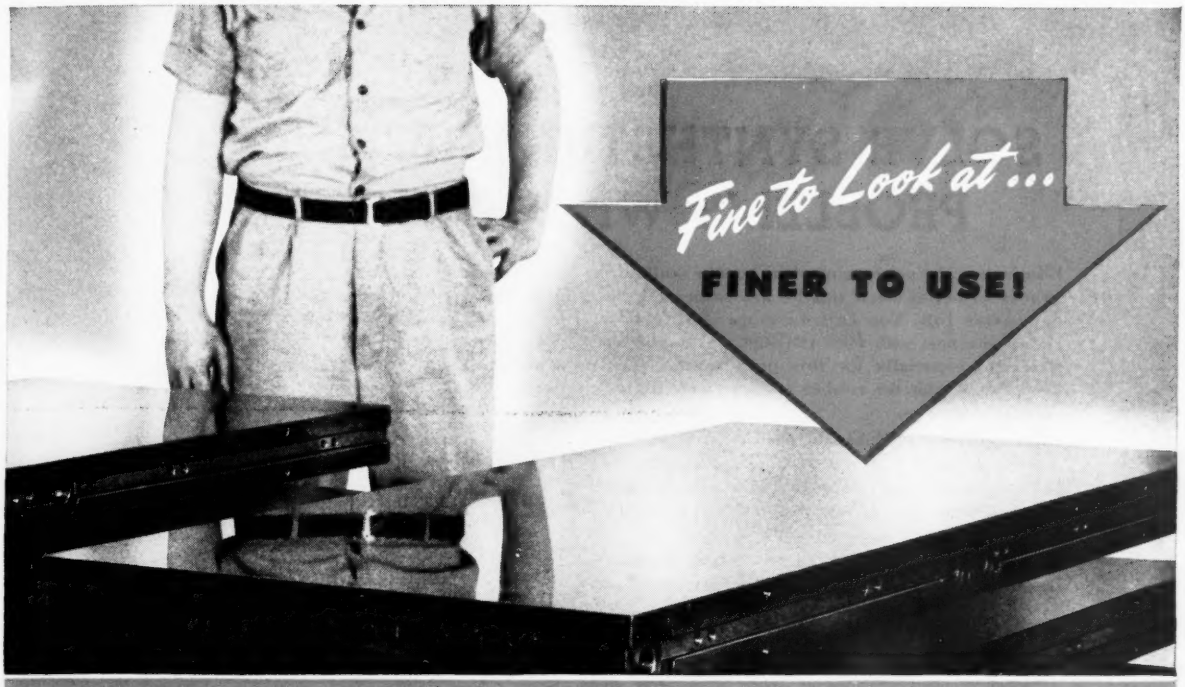

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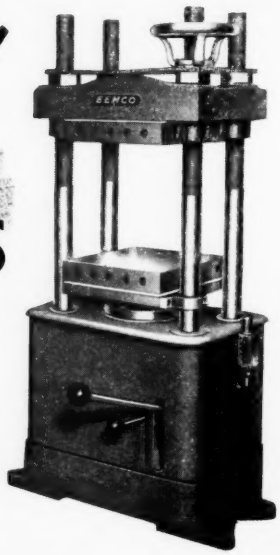
LABORATORY Mills & Presses



The EEMCO Laboratory Mill is entirely enclosed, ready to operate. It is equipped with built-in motor, control and variable speed drive. Mechanism readily accessible.

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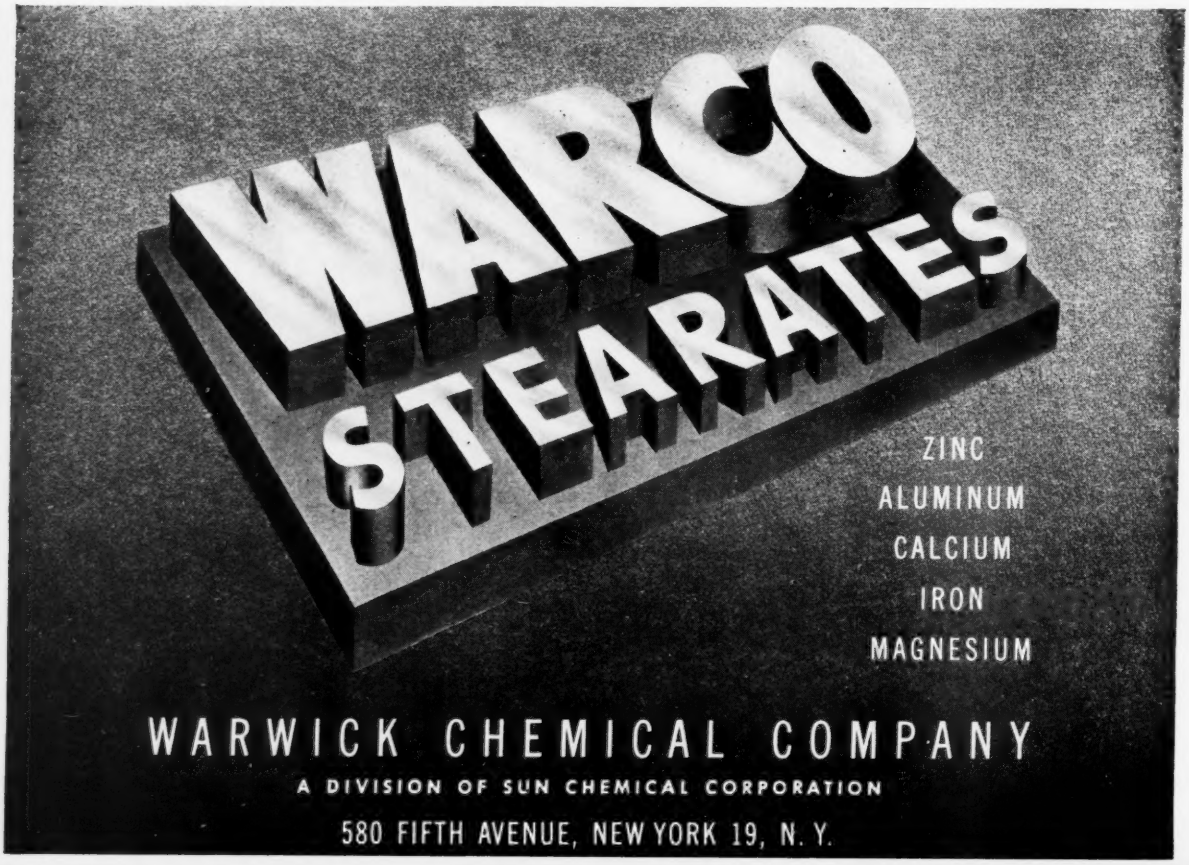
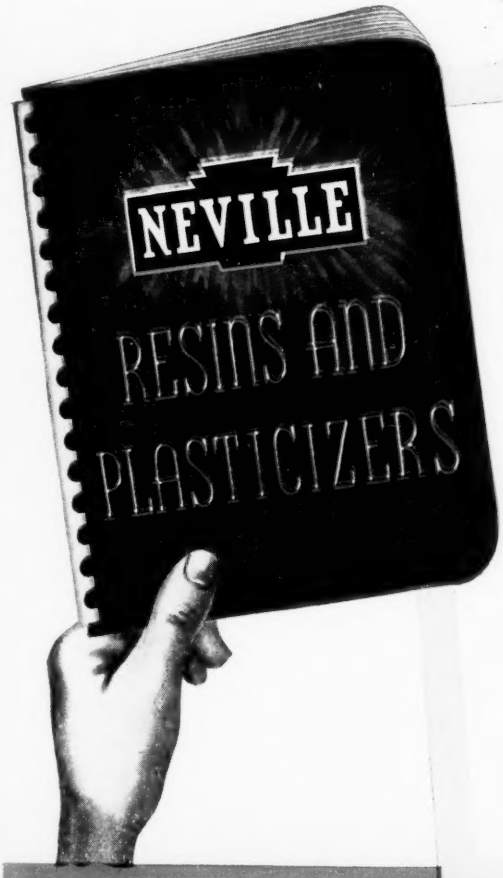


WARWICK CHEMICAL COMPANY
A DIVISION OF SUN CHEMICAL CORPORATION
580 FIFTH AVENUE, NEW YORK 19, N. Y.

Your Guide...

TO THE NEVILLE LINE of Resins and Plasticizing Oils



IT'S Neville's latest hand-book on Resins and Plasticizing Oils, containing a wealth of information that should prove a convenient guide to the proper selection of the right Neville product to meet your problems.

In its 64 pages are listed grades, specifications and uses of each of the many Neville Resins or Plasticizers. Write for your copy today!

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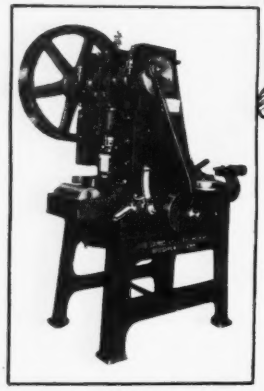

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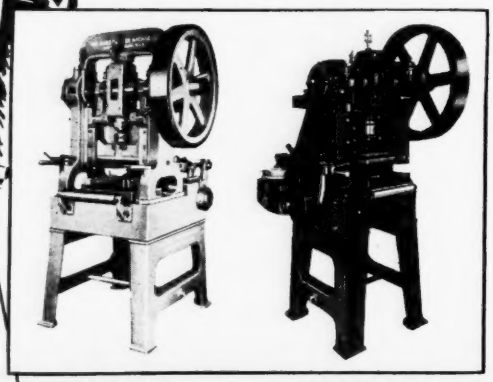

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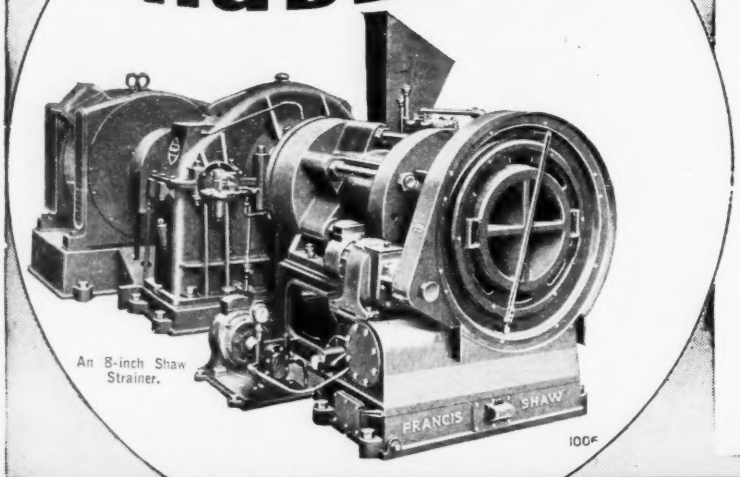

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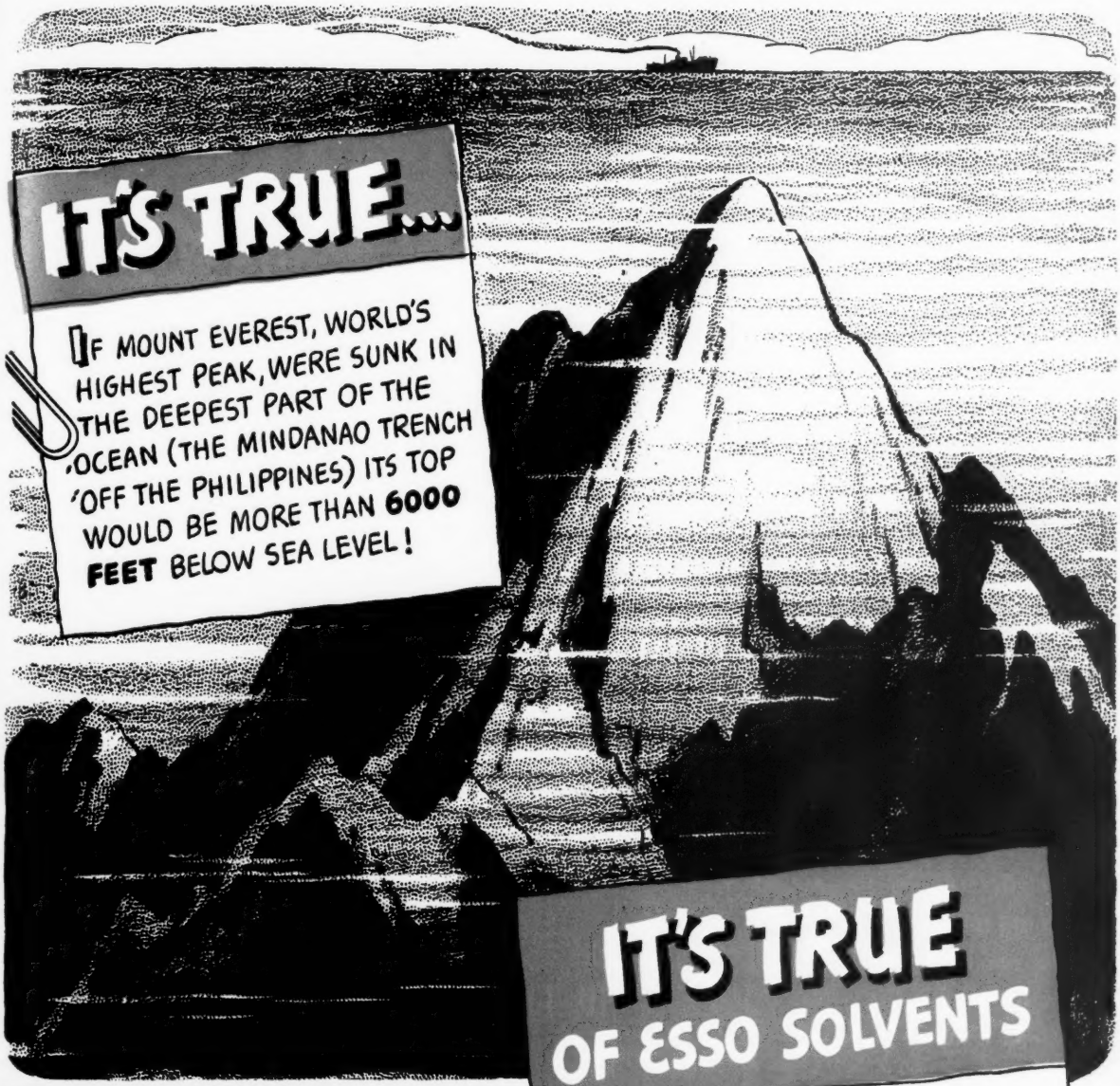
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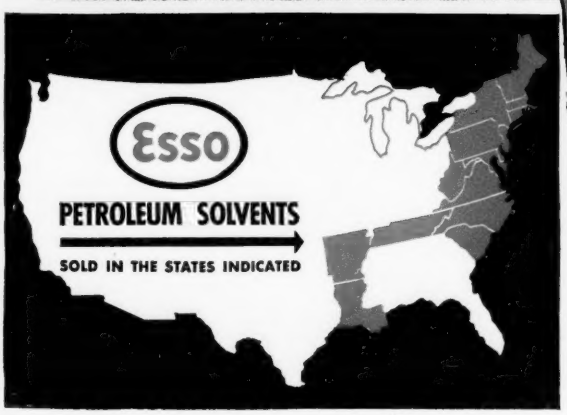

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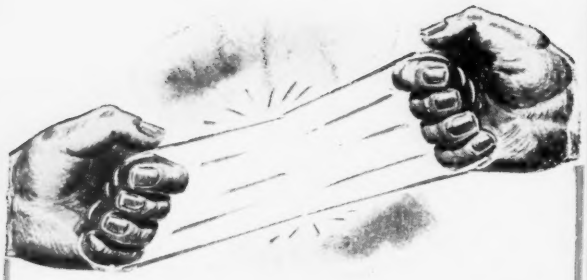

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INDIA
RUBBER WORLD
NATURAL & SYNTHETIC

Volume 115 | New York, January, 1947 | Number 4

The Working of Rubber Regulation[1]

P. T. Bauer

THIS exceedingly interesting article on "The Working of Rubber Regulation" merits close study by readers of India RUBBER WORLD in view of the present-day uncertainty as to the future of natural and synthetic rubber. Certain parts of the author's conclusion may better illustrate this point.

"When full weight is given to the importance of smallholdings, ideas of the supply price of natural rubber need drastic downward revision; a point of significance in assessing the measure of assistance which would be necessary to maintain in profitable operation the American synthetic rubber industry in competition with the plantation product.

"Nor does the outcome serve to confirm the hopes of those who hold that government of industries by trade associations may be acceptable if they are provided with impartial chairmen. The experience of rubber regulation also emphasizes that when government intervenes in economic affairs, the lack of knowledge of economics on the part of civil servants is likely to prove a serious drawback." EDITOR.

THE International Rubber Regulation Scheme was in effective operation from June, 1934, to the early part of 1942, and during this period it controlled 97% of world rubber exports. It was a quota scheme,[2] with basic quotas allotted to the participating territories (which covered more than 99% of the area under rubber), and exports were restricted in accordance with rates of release prescribed by the International Rubber Regulation Committee (I.R.R.C.). This body of representatives of the participating countries was throughout its existence presided over by a high-ranking British civil servant, who was leader and voting member of the Malayan delegation. The leader and voting member of the Netherlands East Indies (N.E.I.) delegation was also a high government official. With quantitatively insignificant exceptions, all the voting members were government officials. The scheme applied equally to estates and small holdings.[3] It is relevant to what follows that, before the Japanese war, rubber was not only much the most important export from the British colonial empire, but that it was also easily the most valuable cash crop grown by small holders in the British or Dutch colonies.

Rubber Regulation in Malaya

Under the Stevenson Restriction Scheme (1922-28) the average assessment per mature acre of Malayan small holdings was about one-half of that of estates. After the withdrawal of that scheme, yields per mature acre on small holdings were regularly much in excess of those on estates (see Table 4), revealing the very substantial under-assessment of the small holders under the Stevenson Scheme. When the 1934 Rubber Regulation Bill was debated in the F.M.S. Federal Council, the Malay spokesman, while supporting the proposed measure, anxiously pleaded for a fair share for small holders in the Malayan territorial quota; he was given emphatic and specific assurances that this time justice would be done.

In the light of these assurances the following five tables[4] are of interest. The first two are purely formal summaries of the division of the Malayan quota.

TABLE 1. INTERNAL DISTRIBUTION OF THE MALAYAN TERRITORIAL QUOTA,* 1934-40

Year	Estates: Thousand Tons	Estates: % of Malayan Quota	Small Holdings: Thousand Tons	Small Holdings: % of Malayan Quota
1934	312.5	61.1	199.1	38.9
1935	334.6	62.5	200.4	37.5
1936	352.6†	61.7	219.4	38.3
1937	373.2	61.8	230.9	38.2
1938	377.4	61.7	234.5	38.3
1939	395.9	61.9	244.0	38.1
1940	407.4	62.3	246.4	37.7

*The total of these quotas slightly exceeded the Malayan territorial quota, and this necessitated the eventual introduction of internal cuts (reductions in rates of release below the internationally agreed rate).

†For administrative reasons, some properties owned by Indian money-lenders were transferred in 1936 from the estate to the small holdings quota. Their assessments totaled some 6,000 tons, and to this extent all the tables slightly overstate the "true" small holdings quota from 1936 onward.

[1] Reprinted from *Economic J.*, 41, 391 (1946). Quarterly Journal of The Royal Economic Society, London, England. Extracted from material collected by the writer as Leon Fellow of the University of London.

[2] Some definition of these terms is necessary. By *quota* is meant the agreed notional productive capacity, under reasonably favorable conditions, of each individual territory, calculated on the basis of 1929-32 exports, with allowances for areas immature during this period. The permissible output of any year was determined by the *rate of release* fixed by the international committee. The *actual output* in any year was usually in close accord with the *rate of release*.

[3] The distinction between estates and small holdings has always been clear, although the official line of division varies slightly in the different rubber producing territories. The estates are units of several hundred or thousand acres each, operated with substantial capital, and employing a large labor force in receipt of a cash wage. The small holdings are essentially peasant holdings of two or three acres each, usually worked by the owner and his family, occasionally employing outside labor on a share basis. The small holders are practically always referred to as natives, which is formally inaccurate for Malaya, British North Borneo, and Sarawak (though not for the N.E.I.), where many of the holdings are owned and worked by Chinese and not by Malays. Moreover "native" carries a connotation of inefficiency which certainly does not apply. Measured by long-period supply price, the small holders are the more efficient class, though their methods necessarily differ from those of the estates. For example, the much greater planting density on small holdings reflects the absence of cash wage costs speaking broadly, the small holder tries to maximize the yield per acre and the estate the yield per tree—a point very generally overlooked by European observers. The economics of the different planting densities is an interesting and complex subject which cannot be discussed in detail here.

[4] They have been derived from the official annual reports of the Controller of Rubber, and from the official annual "Malayan Rubber Statistics Handbook" supplemented in a few instances by reference to records of the I.R.R.C.

TABLE 2. QUOTAS OF MALAYAN ESTATES AND SMALL HOLDINGS EXPRESSED IN POUNDS PER ACRE, 1934-1940
(To the Nearest 5 Pounds)

Year	Estates		Small Holdings	
	Per Acre	Per Mature Acre	Per Acre	Per Mature Acre
1934	350	365	340	365
1935	375	405	340	355
1936	390	420	375	385
1937	415	450	395	400
1938	425	455	400	405
1939	430	470	405	420
1940	435	500	405	425

The results of the quota division emerge from Tables 3-5.

TABLE 3. COMPARISON OF PREVIOUS OUTPUT* OF MALAYAN ESTATES AND SMALL HOLDINGS WITH THEIR 1934 QUOTAS
(Tons, to the Nearest 5,000 Tons)

	Estates	Small Holdings	London Price, Pence per Pound
(a) Output for calendar year 1933	240,000	220,000	3.2
(b) Output for 12 months ending May, 1934	250,000	250,000	4.5
(c) Annual rate of production based on seasonally corrected output, March-May, 1934	265,000	300,000	5.8
(d) 1934 quotas	310,000	200,000	..
(e) (d) as % of (a)	129	91	..
(b)	124	80	..
(c)†	117	67	..

*These are production figures; stock changes are allowed for.
†In the Spring of 1934 the price was nearer to the price visualized under restriction than it had been in 1933. The quotas of different classes of producer may be considered fair if their ratio is roughly proportionate to approximate unrestricted outputs at the prices envisaged under restriction. This lends special interest to the comparison of (c) with (d).

TABLE 4. ANNUAL OUTPUT OF RUBBER PER MATURE ACRE OF MALAYAN ESTATES AND SMALL HOLDINGS, 1929-1940
(Pounds to the Nearest 5 Pounds)

Year	Estates	Small Holdings	Small Holding as % of Estates
1929	410	485	118
1930	380	460	121
1931	375	445	119
1932	365	385	106
1933	355	465	131
1934	Regulation introduced during the year		
1935	295	240	81
1936	275	230	84
1937	375	330	88
1938	290	200	69
1939	290	200	69
1940	410	370	90

These figures have been calculated by dividing the actual output by the mature area, *i.e.*, by the acreage five or more years old. The sharp fluctuations in the last column in 1932-33 reflect the small holders' reaction to the very low prices of 1932, and to the recovery of 1933, and show the forward rising supply curve of small holders' rubber. The very low figures in the last column in 1938-39 are explained by sales of rights by small holders to estates; in 1940 the sales were in the reverse direction. These transactions are discussed in the text.

TABLE 5. SHARES OF ESTATES AND SMALL HOLDINGS IN MALAYAN RUBBER PRODUCTION, 1929-40

	Estates		Small Holdings	
	Tons	As % of Total Malayan Production	Tons	As % of Total Malayan Production
1929	246,000	55.2	200,000	44.8
1930	236,000	54.6	197,000	45.5
1931	240,000	55.1	197,000	44.9
1932	240,000	57.6	177,000	42.4
1933	240,000	52.2	221,000	47.8
June-Dec., 1933	149,000	50.9	144,000	49.1
June, 1933-May, 1934	251,000	49.7	253,000	50.3
Jan.-May, 1934	102,000	48.3	107,000	51.7
	Regulation introduced			
June-Dec., 1934	160,000	59.7	108,000	40.3
1935	243,000	64.0	137,000	36.0
1936	233,000	63.9	132,000	36.1
1937	314,000	62.4	189,000	37.6
1938	246,000	68.1	115,000	31.9
1939	245,000	67.7	117,000	32.3
1940	334,000	60.8	215,000	39.2

The implication of these tables is clear. To forestall possible objections it must be stated at once that sales of rights from small holders to estates, whether directly or indirectly (*via* dealers who buy coupons first and uncouponed rubber subsequently), were negligible during this period, except in 1938 and 1939, when such sales took place to a small extent—about 5% of the total quota in each year. In 1940, net sales were in a reverse direction, and the estates sold rights to small holders *via* the dealers. The position can be ascertained at a glance by comparing the shares of estates and of small holdings in Malayan production (Table 5) with their shares in the quota (Table 1). The different trends of the outputs of estates and of small holdings reflect the enforced curtailment of the latter. It needs also to be stated that there was no "overtapping" by the small holders in the years before the introduction of regulation. An official inquiry on bark consumption and bark reserves on Malayan small holdings took place in 1931-33, and it found that the rate of bark consumption was far lower than had been believed, and that it was not in excess of the rate of bark renewal; bark reserves on the trees averaged about 7½ years' bark consumption.[5]

It is possible to estimate very roughly the loss inflicted on small holders by their under-assessment. If the shares of estates and small holdings in the quota had been proportionate to their probable unrestricted outputs at prices visualized under restriction, the quota would have been divided about equally. If the estate and small holdings' quotas had been calculated on the same basis as had been internationally adopted for the computation of the total Malayan quota, the division would have been about 55% for estates and 45% for small holdings. These estimates are subject to a margin of error, but on any reasonable basis of division the share of small holdings should not have been less than 45% and possibly about 48%, especially as it is explicitly claimed in "The History of Rubber Regulation, 1934-1943"[6] that official instructions were issued in 1934 that the small holders were to be given the benefit of any doubt in the division of the quota. On this basis, small holders' quotas over the years 1934-41 should have totaled approximately 400,000 tons more than they actually did, and some two-thirds of this amount, say 270,000 tons, would have been exportable under the restriction scheme. Taking a conservative overall value of export rights at an average of 4*d.* per pound upcountry throughout this period, the loss to small holders may be estimated at about £10 million, or 85 million Straits dollars. As this came about through under-assessment of land which remained under rubber, there was little or no transfer of resources to other uses to be set against the loss.[7]

The data on the administration of rubber regulations in British North Borneo are incomplete, and no official fig-

[5] The results of this inquiry were published in an official booklet "Bark Consumption and Bark Reserves on Small Rubber Holdings in Malaya," Department of Agriculture, S.S. and F.M.S., Economic Series No. 4 (1934). This was the first systematic inquiry into conditions on Mayalan small holdings and had been prompted by the obvious need to revise widely held views. The results were in complete contradiction to the oft-repeated statements of officials and estate spokesmen on "squandering of bark reserves" and "abnormally excessive tapping" on small holdings. It is of interest to note that while the setting up of the inquiry was fully reported in the *Bulletin* of the Rubber Growers' Association, as well as in its 1931 annual report, no reference to the results can be found in these publications. The booklet is almost unknown in this country. Copies are available in the Colonial Office library and in the excellent library of the Research Association of British Rubber Manufacturers.

In the autumn of 1933 the application of rubber restriction to Malaya was considered by a committee of the Rubber Growers' Association. Its recommendations were embodied in the unpublished, but widely circulated report, intended chiefly for the benefit of the Malayan administrations. The suggestions on the internal division of the quota were remarkably fair, indeed favorable to the small holders, and had the proposals of the representatives of large estate been adopted, the small holders would have fared better than they actually did under the auspices of the local governments.

[6] P. 47. George Allen & Unwin, Ltd., London (1944).

[7] This is, of course, not to dispute the obvious fact that small holders' incomes were substantially higher under regulation than they would have been in its absence. For considerable periods Malayan small holders enjoyed higher incomes by selling coupons without any work than they would have earned without restriction by tapping their trees. According to an American consular dispatch in 1939:

"Malayan small holders regard their export coupons as a pension . . . and would almost certainly object to the discontinuance of control." (U. S. Department of Commerce, *Rubber News Letter*, Dec. 15, 1939.)

ures are available before 1939 on the division of the territorial quota between estates and small holdings. In that year the average assessment of estates was about 500 pounds per mature acre, and that of small holdings, about 215 pounds, although the yielding capacity of the latter was unquestionably higher. From fragmentary data it appears that much the same ratio between the assessments of estates and of small holdings prevailed throughout the operation of restriction. In 1936-37 a series of tapping experiments took place in Sarawak (just across the frontier from British North Borneo) under the auspices of the Malayan Survey Department. The average yield on the small holdings examined was 489 pounds per mature acre. It appears that the small holders were worse treated in British North Borneo than in any other territory.[8]

Rubber Regulation in N.E.I.

The N.E.I. native quota was also inadequate, so much so indeed that this almost wrecked the whole regulation scheme in 1935. For various reasons, chiefly the absence of acreage statistics and administrative changes and quota revisions, it is not possible to present a series of tables for the N.E.I. similar to Table 1-5 for Malaya. There is, however, no lack of data to show in broad outlines the treatment of the small holders.

TABLE 6. COMPARISON OF PREVIOUS OUTPUT OF N.E.I. ESTATES AND NATIVES WITH THEIR 1934 QUOTAS

(Long tons, to the Nearest 5,000 Tons)

	Estates	Natives*	London Price, Pence per Pound
(a) Output for calendar year 1933.....	170,000	115,000	3.2
(b) Output for 12 months ending May, 1934	180,000	185,000	4.5
(c) Annual rate of production based on seasonally corrected output, March-May, 1934	220,000	300,000	5.8
(d) 1934 quotas	205,000	145,000	..
(e) (d) as % of (a).....	121	126	..
(b).....	114	78	..
(c)†.....	93	48	..

*For the natives exports have been taken as output. The export figures for March-May probably include some reduction in stocks and thus slightly overstate the actual output. The amount involved is, however, certain to be very small. The natives kept no stocks, and dealers' stocks were also comparatively small; moreover the exports were fully in accordance with the rising trend since mid-1933.

†The considerations summarized in the second note to Table 3 also apply to these figures. Moreover in the N.E.I. very large native areas were reaching maturity in about 1933-34 for which little or no allowance was made in the 1934-35 quotas. It should also be noted that the supply of N.E.I. native rubber was definitely elastic, and the 1933 production was at a rate of only about one-third of the officially and very conservatively estimated capacity.

During the first two and a half years of restriction, from June, 1934, to December, 1936, there was no individual restriction of native small holders in the N.E.I., and their exports were kept in check by means of a special export tax (special as distinct from the ordinary *ad valorem* tax levied on the f.o.b. value of native exports). This was designed to depress the price of native rubber in the interior sufficiently to keep exports within the permissible limits, calculated from the total native quota and the international rates of release. It is generally believed that the absence of land survey and registration in Sumatra and Borneo was the sole reason for the introduction of the special tax as a method for restricting native exports. The main reason, however, was the inadequacy of the native quota, which until 1937 did not permit of individual assessments. The official nineteenth "Report on Native Rubber Cultivation in the Netherlands East Indies"[9] stated explicitly that individual restriction was impossible, first because registration would require too much time, money, and labor, "but more especially because the potential production of native rubber is considered to be so great that a division of the permissible exportable amount, based on productive capacity, would result in the individual allotment being very small, and as a result some natives who depend for their existence entirely upon family tapping would be seriously affected, while owners of distant gardens worked with hired labor would benefits, and such owners cannot in the present circumstances be regarded as real producers." It should be understood that the "present circumstances" did not mean that the supply price of these producers was too high, but that the quota was too small to go round.

The working of the special export tax is shown in Table 7. The assumptions and data underlying the calculations are summarized in Note A at the end of this table. While the table, read together with the note, explains itself, the following points may be emphasized. Had the expenses (columns 4 and 5) been taken as the equivalent of 4½ guilder cents per half kilo (the figure more generally accepted, see Note A) instead of 4 guilder cents, the average rate of tax would on several occasions have exceeded 6,000%; on our calculations the maximum reached was about 2,100%. The 5% *ad valorem* revenue export tax, which was levied on the f.o.b. value after payment of the special tax, frequently exceeded 40% of the value ex the special tax.

It will be noted that in 1936 native rubber exports totaled 150,000 tons, with an f.o.b. price of about 1*d.* per pound. Around 1930 several observers put forward estimates of the supply price of N.E.I. native rubber during the mid-1930's.[10] These were generally in terms of 10*d.*-1*s.* per pound as the minimum necessary to draw out 120,000-150,000 tons of native rubber. Moreover the estimates were in terms of undepreciated sterling; while, with the exception of the last quarter of 1936, throughout the period covered by Table 7 sterling was heavily depreciated in terms of the N.E.I. guilder, and a given sterling price in 1934-36 yielded a much lower guilder return to the N.E.I. natives than in 1929-31. By 1933-34 it had already become clear that these estimates of the prospective supply price were entirely mistaken, as, for instance, in the Spring of 1934, N.E.I. native exports were running at the yearly rate of 300,000 tons, with a London price of 5½*d.*-6*d.* per pound[11] in depreciated sterling. The substantial exports of 1934-36 revealed that the supply price of N.E.I. native rubber was a small fraction of the usual estimates.

Throughout the period of the operation of the special tax the I.R.R.C. repeatedly stated that the market price was appreciably below the level which would have yielded a "reasonable return to efficient producers;" this was moreover quite recently restated in "The History of Rubber Regulation." The inadequacy of the market price of those years was also a regular theme of the presidential addresses to the Rubber Growers' Association. Yet close on three-quarters of these prices had to be taxed away to keep N.E.I. native exports within permissible limits. According to the official I.R.R.C. view, a London price of 8*d.* was the bare minimum to furnish a "reasonable return to efficient growers;" the figures in Table 7 are a fair comment on these hackneyed concepts.

[8] In Ceylon the per acre assessments of estates greatly exceeded those of the small holdings, and it is highly probable that there, too, the small holders were under-assessed, but for various technical reasons this cannot be shown so clearly as it can be for the other territories.

[9] Issued by the Division of Agricultural Economics in the N.E.I. Departments of Agriculture, Batavia, 1934.

[10] Some of these are listed by J. W. F. Rowe in London & Cambridge Economic Service, "Special Memorandum No. 34," p. 71 (1931).

[11] The exports of small holders' rubber from all the producing territories were at the annual rate of close on three-quarters of a million tons in the Spring of 1934. Huge native areas were, moreover, still immature at that time, reaching maturity in the late 1930's only. The 1934 exports were the product of family tapping only and were all harvested from unselected seedling trees. Thus very large quantities of native rubber would be unaffected by a rise in money wages in the Far East; while the long-period supply price may be reduced if high-yielding planting material were distributed to small holders. These are important considerations in gaging the competitive strength of natural and synthetic rubber.

TABLE 7. THE WORKING OF THE SPECIAL EXPORT TAX ON NATIVE RUBBER EXPORTS IN THE N.E.I.
June, 1934-December, 1936

Year	(1) Singapore Price of Medium Blankets, Expressed in Pence per Pound	(2) Ordinary N.E.I. Export Duty on Native Rubber at 5% ad Valorem of F.O.B. Values, Pence per Pound	(3) Special N.E.I. Export Duty on Native Rubber Average Rate for Month (Dry) Pence per Pound	(4) Approximate Cost of Shipping from N.E.I. Port to Singapore, Processing and Marketing, Pence per Pound	(5) Approximate Expenses from Interior to N.E.I. Port, Pence per Pound	(6) Approximate Average Return to Native Producer, Pence per Pound	(7) Singapore Price ex Export Duties Pence per Pound	(8) Approximate Price F.O.B. N.E.I. Port, Pence per Pound	(9) Approximate F.O.B. Price ex Export Duties N.E.I. Port, Pence per Pound	(10) Ordinary N.E.I. Export Duty as Percentage of: (a) F.O.B. Price ex Export Duties (Col. 9)	(10) Ordinary N.E.I. Export Duty as Percentage of: (b) Average Return to Native Producer (Col. 6)	(11) Special N.E.I. Export Duty as Percentage of: (a) Singapore Price (Col. 1)	(11) Special N.E.I. Export Duty as Percentage of: (b) Price ex Export Duties (Col. 9)	(11) Special N.E.I. Export Duty as Percentage of: (c) Average Return of Native Producer (Col. 6)	(12) Exports of Native Rubber Dry Weight (Long Tons)	(13) Permissible Exportable Amount ex Carryover (Long Tons)
1934																
June	4.8	0.1	..	0.9	0.2	3.6	4.7	3.9	3.8	4	4	..	..	..	16,000	12,229
July	5.2	0.2	0.7	1.0	0.2	3.1	4.3	4.2	3.3	5	6	13	23	24	16,200	12,229
Aug.	5.4	0.2	1.9	1.0	0.2	2.1	3.3	4.4	2.3	8	8	35	83	89	12,600	11,006
Sept.	5.4	0.2	2.7	1.0	0.2	1.3	2.5	4.4	1.5	14	16	50	180	200	15,600	11,006
Oct.	5.1	0.2	3.0	1.1	0.1	0.7	1.9	4.0	0.8	24	19	59	345	417	5,600	9,784
Nov.	4.8	0.2	3.0	1.0	0.1	0.5	**1.6**	**3.8**	6.6	32	41	62	455	588	4,700	9,784
Dec.	4.9	0.2	2.7	1.1	0.1	0.8	2.0	3.8	0.9	23	27	55	290	346	12,200	8,560
Last seven months of year	5.1	0.2	2.0	1.0	0.1	1.8	2.9	4.1	1.9	9	10	39	103	112	82,900	74,598
1935																
Jan.	5.0	0.2	2.4	1.1	0.1	1.2	2.4	3.9	1.3	14	15	48	182	205	9,600	10,423
Feb.	4.9	0.2	2.4	1.1	0.1	1.1	2.3	3.6	1.2	14	16	49	190	216	16,900	10,423
Mar.	4.7	0.2	2.5	1.1	0.2	0.7	2.0	3.6	0.9	21	25	53	276	333	8,900	10,423
Apr.	4.7	0.2	2.4	1.1	0.1	0.9	2.1	3.6	1.0	17	20	51	229	267	13,600	9,728
May	5.0	0.2	2.4	1.1	0.1	1.2	2.4	3.9	1.3	13	15	48	178	200	22,200	9,728
June	5.3	0.2	2.4	1.0	0.1	1.6	2.7	4.3	1.7	11	12	45	140	154	14,300	9,727
July	5.2	0.2	2.7	1.1	0.2	1.0	2.3	4.1	1.2	18	20	53	230	263	8,100	9,033
Aug.	5.3	0.2	3.1	1.0	0.2	0.8	2.9	4.3	1.0	23	27	59	339	404	9,700	9,033
Sept.	5.2	0.2	3.0	1.0	0.2	0.8	2.0	4.2	1.0	23	27	58	323	385	9,600	9,033
Oct.	5.4	0.2	3.0	1.1	0.1	1.0	2.2	4.3	1.1	18	21	55	256	294	17,500	8,339
Nov.	5.8	0.2	3.4	1.0	0.2	1.0	2.2	4.8	1.2	18	20	58	283	323	9,100	8,338
Dec.	5.9	0.2	4.2	1.0	0.2	0.3	1.5	4.9	0.5	53	80	71	927	1,390	2,800	8,338
Year 1935....	5.2	0.2	2.8	1.0	0.2	1.0	2.2	4.2	1.2	19	22	54	254	294	142,300	112,566
1936																
Jan.	6.5	0.3	4.3	1.0	0.2	0.7	1.9	5.5	0.9	29	35	67	518	631	9,200	12,085
Feb.	7.0	0.3	4.3	1.0	0.2	1.2	2.4	6.0	1.4	17	20	62	315	354	16,100	12,084
Mar.	7.2	0.3	4.6	1.1	0.2	1.0	2.3	6.1	1.2	23	26	65	388	443	9,300	12,085
Apr.	7.3	0.3	4.9	1.0	0.2	0.9	2.1	6.3	1.1	29	33	67	471	550	12,500	12,084
May	7.1	0.3	5.1	1.0	0.1	0.6	1.7	6.1	0.7	40	50	71	684	855	10,700	12,085
June	7.1	0.3	5.0	1.0	0.2	0.6	1.8	6.1	0.8	37	45	70	630	773	14,600	12,084
July	7.4	0.3	5.0	1.0	0.2	0.9	**2.1**	6.4	1.1	29	33	68	489	570	18,100	13,092
Aug.	7.3	**0.3**	5.4	1.0	0.1	0.5	1.6	6.3	0.6	45	59	73	828	1,071	11,800	13,092
Sept.	7.4	0.3	5.4	1.0	0.2	0.5	1.7	6.4	0.7	48	61	73	813	1,039	9,800	13,091
Oct.	7.6	**0.3**	6.1	0.8	0.1	0.3	1.2	6.8	0.4	65	92	80	1,494	2,117	12,000	13,092
Nov.	8.4	0.3	6.4	0.8	0.1	0.8	1.7	7.6	0.9	30	34	76	724	838	16,400	13,092
Dec.	9.3	0.3	6.7	0.8	0.2	1.3	2.3	8.5	0.2	24	26	72	479	525	8,800	13,091
Year 1936 ...	7.5	0.3	5.3	0.9	0.2	0.8	1.9	6.6	1.0	32	38	72	616	735	149,300	151,057

NOTE A:

Although some of the figures in Table 7 contain an element of estimate, they well illustrated the working of the special export tax. The figures in columns 10 and 11 for the last seven months of 1934 and for the years 1935 and 1936 are not the simple averages of the monthly percentage figures but the averages of the monthly percentages weighted by the corresponding various prices. Conversion of various items from guilder cents to pence, with inevitable rounding off, also involved a few small inaccuracies in calculating the percentages.

Throughout most of the period reviewed, the bulk of N. E. I. native rubber was marketed as medium blankets; hence the choice of that grade for the prices in column 1.

There is a wide measure of agreement among competent authorities on the average cost of transport, processing, and middlemen's charges from the most important native districts to the Singapore market. Dr. Whitford and the N.E.I. authorities estimated the figure at about four to five guilder cents per ½ kilo of dry rubber in the mid-1930's. The largest remiller in Singapore has recently, in private conversation, given an independent estimate of 4½ guilder cents. A figure of four cents has been adopted in the tables to insure that any error should be on the side of conservatism and should understate rather than overstate the burden of the tax. About ½ cent has been taken to represent the cost of transport and middlemen's charges from the interior to the N.E.I. port of shipment, and the balance as the cost of shipping to Singapore, and of processing and marketing there. These figures exclude the ordinary *ad valorem* export duty which has been calculated, as it was levied, on the basis of 5% of the export value of native rubber during the second preceding month.

The average rate of duty in the table refers to the effective rate in force and not to the rates announced during the month; hence the zero rate of June, 1934.

The violent fluctuations in the net return to native producers (column 6) indicate the disproportionate effect in the interior of changes in the market price or in the rate of duty. There is room here for an appreciable margin of error in any given month, but the yearly, or even quarterly, averages are unlikely to be seriously affected.

The export figures are accurate; the wide month-to-month fluctuations reflect the reaction of shippers to the announcement of changes in the rate of the special tax, and to a lesser extent their views on the probable course of the market. There was a time lag between the announcement of changes in the rate of the special tax and the date the new rate applied to dry rubber, and this led exporters to accelerate or withhold shipments in the interim period. These erratic fluctuations cancelled out over a period and did not affect total shipments over, say, six months.

When the special export was introduced, the N.E.I. authorities gave special and unequivocal guarantees that the receipts would be used solely for the benefit of the native rubber-growing districts, over and above the expenditure allotted to these areas out of the general revenue.[12] The proceeds of the special tax were, however, so large that the authorities were unable to resist the temptation, and a substantial proportion of the proceeds was diverted to the general revenue. The government defended this policy on the grounds that the natives produced at such low cost that even the 1934-36 returns were profitable, while other sections of the N.E.I. economy, notably the rubber estates, were doing very badly.[13]

Planting Provisions of Regulation Scheme

The planting provisions of the regulation scheme also operated to the disadvantage of the small holders. Briefly, these prohibited new planting almost completely (with the exception noted in the following paragraph), while permitting at first a very large measure of replanting, and eventually unlimited replanting. To appreciate the effect of these provisions it is necessary to consider some semi-technical aspects of planting practice.

By replanting is meant the uprooting of an existing stand of rubber trees and their replacement by better-yielding material while new planting is in effect the extension of the planted area. During 1934-38 (the currency of the first regulation period) new planting was completely prohibited while a maximum of 20% of the planted area could be replanted over this period. In the aggregate this implied virtually unlimited replanting, since it authorized the replanting of about 1.6 million acres (one-fifth of the total 1934 planted area of about eight million acres) within four and a half years. Each individual owner was, however, also limited to replanting a maximum of 20% of his acreage under rubber during the whole period and was only allowed to replant 10% in any given year. In 1939-40 new planting equivalent to 5% of the existing acreage was allowed; for the remaining years of the effective regulation new planting was totally forbidden; replanting, on the other hand, was unlimited from 1939 onward.

These arrangements jeopardized the future of the native rubber industry. Replanting involves a total loss of income for six years from the area felled, since it takes six years for the trees to become tappable.[14] Thus this operation could only be contemplated by producers with ample working capital—*i.e.*, in practice the larger estates, whose managers and owners, moreover, realize that by cutting out a part of their substantial acreage, they could harvest from the remaining area the crop they would be allowed to export under the scheme. This policy already insured that the small holders would not undertake any replanting. During the first regulation period they could not possibly have replanted, as each owner was limited to replanting a maximum of 10% of his plantation in any one year and to 20% over the whole period. It is impossible to replant successfully part of a holding totaling two or three acres or less, since the area to be replanted would be closely surrounded by mature trees which would intercept the sunlight and whose roots would compete for food with the undeveloped rootlets of the newly planted trees. Moreover the small holders practice a rough-and-ready rotational system of tapping and resting trees, not entire areas, and they are thus unable to fell part of their areas and harvest the crop from the balance, even if this practice were technically feasible, which it is not. Lastly, when permission to replant was applied for, a host of technical information had to be submitted to the authorities in writing, and this policy again handicapped the small holder, who never understood the procedure. The combined result of these various factors was to confine replanting to estates.

The replanting of the estate acreage with high-yielding material, together with the prohibition of new planting, would in the long run have eliminated the small holders.[15] The physical decay of small holdings would have been slow since under native conditions the rubber tree is not so much of a wasting asset as has often been assumed. Nevertheless in due course there would have been some decline, particularly in areas with a long history of previous cultivation with such food crops as pineapples or tapioca, which make substantial demands on the soil; and unless the small holders had been allowed some new planting, their share in the total output would have gradually decreased. Much more important in practice was the danger that the small holders might have been eliminated as effective economic competitors, since without new planting they could not have taken advantage of high-yielding modern planting material. In this context it should be noted that not only is there unlimited land available in the more important rubber-growing areas, but that the rubber tree takes next to nothing out of the soil, and under native conditions actually nothing which would not be put back by the dense cover and the heavy leaf-fall; there is thus no question of soil mining such as has occurred in many countries with apparently unlimited resources of land. An abandoned rubber small holding reverts to secondary jungle with *Hevea* seedlings predominating, and in a few years' time it is as suitable for native rice or rubber-growing as before. In certain areas in the East, especially in the N.E.I., a secondary jungle of rubber seedlings is actually beneficial, as it helps to keep out *lalang* (*imperata arundinacea*, a dangerous speargrass), which, when once established over large areas, is difficult to clear up, and also because rubber forests are less liable to burn than most other jungle plants. The need of replanting on estates arose in the past through loss of soil from erosion, loss of stand through root disease, and, above all, from rapid development of high-yielding material which rendered obsolete the original stand. There was no case for prohibiting the small holder to extend his acreage while allowing the estates to increase their capacity.

Under the renewed regulation scheme (1939-43) a total of 5% new planting (5% of the 1938 acreage) was allowed in 1939-40, after which date the International Rubber Regulation Committee was to decide the permissible rate of new planting and also to declare whether unlimited replanting was to continue for the remaining years of regulation. These matters were decided at two meetings in February and May, 1940. At the first, unlimited replanting was permitted until the end of the current scheme. For the second meeting, in view of the important decision which was to be taken, a special statistical annex to the agenda was prepared and circulated by the Secretariat. This annex contained some in-

changes in the rate of the special tax and the date the new rate applied to dry rubber, and this led exporters to accelerate or withhold shipments in the interim period. These erratic fluctuations cancelled out over a period and did not affect total shipments over, say, six months.

dependent estimate of 4½ guilder cents. A figure of four cents has been adopted in the tables to insure that any error should be on the side of conservatism and should understate rather than overstate the burden of the tax. About ½ cent has been taken to represent the cost of transport

[12] The official nineteenth N.E.I. "Report on Native Rubber Cultivation," which we have already quoted, stated in 1934, "The principle that the proceeds shall be spent for the benefit of the inhabitants of the rubber-producing areas is inseparably bound up with this particular system of restriction. This tax is not a fiscal device, but a means to secure restriction. A proportion of the proceeds is withheld from the exporter, and this is defensible only if the amounts so withheld are spent at once for the benefit of the districts from which the money was derived."

[13] An official spokesman, addressing the Batavia Volksraad in 1936, argued that the natives had no costs, and that the price, even after the heavy export tax, was remunerative to them; while the world price (several times the return left to the natives) hardly enabled the estates to survive.

[14] The Rubber Research Institute of Malaya estimated in 1938 that estates required about 12 years to recoup the cash expenses and the loss of income from replanting.

[15] During the first regulation period (1934-38) there was comparatively little replanting by estates, and the danger to the native industry was potential rather than actual. There was, however, a gradual increase in the acreage replanted annually, and this was much accelerated from 1939 onward.

teresting forward estimates of future absorption and potential capacity.

Two sets of capacity estimates were drawn up: one on the assumption that the estates would replant 70,000 acres annually, while the natives (small holders) would not replant at all; the other on the assumption that estates would replant 70,000 acres and natives 40,000 acres a year. The former was rightly stated to be more plausible. No new planting was assumed after 1940. No attempt was made to estimate the price required to call forth the full capacity output. The following results emerged.

TABLE 8. SUMMARY OF ESTIMATES BY THE I.R.R.C. SECRETARIAT OF FUTURE PHYSICAL PRODUCTIVITY OF PLANTATION RUBBER

(Tons)

	Estates		Small Holdings		
Year	Tons	% of Total Capacity	Tons	% of Total Capacity	Total Capacity
Assumption A: annual replanting of 70,000 acres by estates, no replanting by small holders					
1939	812,000	53.1	716,000	46.9	1,528,000
1950	992,000	61.1	631,000	38.9	1,623,000
1960	1,037,000	74.2	360,000	25.8	1,397,000
Assumption B: annual replanting of 70,000 acres by estates and of 40,000 acres by small holders					
1939	812,000	53.1	716,000	46.9	1,528,000
1950	992,000	61.7	617,000	38.3	1,609,000
1960	1,037,000	71.6	412,000	28.4	1,449,000

The divergent trends of the capacity of estates and of small holdings reflected replanting by estates with high-yielding modern material, while the capacity of small holdings declined with their advancing age; on Assumption A, one-third of the small holdings area would be more than 30 years old by 1950, and over six-sevenths by 1960, and 30 years was believed to be the limit of the economic life of the holdings.[16] On Assumption B, the rate of decline was not so steep, but some reduction was still postulated, as the small holders were assumed to use unselected seedling material for replanting, and this practice was not expected to offset the decline in yield from the older areas.

These figures revealed very clearly that the outcome of a policy which prohibited new planting, while permitting a large measure of replanting, would be a large reduction in the small holders' share of total rubber production. The rate of decline of the physical productivity of small holders' rubber assumed for the calculation was almost certainly too steep, and the estimates of future physical capacity were unduly pessimistic. This was stated in the memorandum as well as in the course of its discussion by the I.R.R.C. But while it might have been conjectural just how rapidly, and to what extent, the estates would have gained supremacy as a result of the planting provisions, the general trend was both unmistakable and unavoidable. Because of the replanting of estates with high-yielding material the small holders would be ousted as economic competitors, even though their physical capacity still remained in existence (or even if it remained intact, which was, however, impossible), and this, however efficient they might have been at the outset.

With these obvious considerations clearly before them, the Committee, who had decided on unlimited replanting in February, now resolved on a total prohibition of new planting throughout 1941, the position to be revised again at the end of that year. Disregarding the chronological order, it may be stated that it was then decided to prohibit new planting completely for the remaining period of regulation.

While the threat to the position of the small holders (the lowest-cost producers) was the most striking feature of the planting provisions of rubber regulation, two further points need to be recorded. First, as the authorities insisted that replanting should take place on the exact area of the previous stand, improved planting material (chiefly high-yielding budgrafts) was frequently wasted, as it had to be planted on exhausted or unsuitable soil, or on badly sited plantations.

Secondly, replanting expenditure was admitted as a charge against income tax by the revenue authorities, while the assessment for restriction purposes of areas cut out for replanting was maintained. Thus, when in 1940 the British excess profits tax was raised to 100%, companies earning in excess of their standard profits had everything to gain and nothing to lose by replanting on a larger scale. In 1940 there was a great increase in replanting activity, which continued at a rising rate until January, 1942, absorbing ever-increasing amounts of scarce resources and aggravating the deficiency of exports which developed early in 1941. No action was taken by the authorities; in fact, replanting was encouraged by the maintenance of the assessments of the old area. Only the Japanese conquest put an end to the replanting campaign, and to the waste of resources involved.[17]

Restricting Effect of Export Rights

Throughout the regulation period there was fairly free, though not altogether unrestricted, transfer of export rights in the principal producing territories. Table 9 summarizes the price of these rights during the second month of each restriction quarter; this month has been chosen to eliminate the often violent fluctuations in the price of these export rights at the very beginning and end of the quarter. The qualifications and sources of the data are set out in Note B at the end of this table. It should be noted that the Malayan prices of estate export rights and small holders' export coupons are up-country quotations and 1½-2 cents per pound should be added to these for export duty and transport costs to render them comparable to the Singapore price, which was the world price after payment of duty.

These figures are of particular interest for the first half of 1937, the second half of 1940, and for 1941, as the I.R.R.C. maintained that the releases ruling during these periods represented unrestricted production, and that supplies could not have been increased by higher releases. They were particularly emphatic that the 100% release of the first three quarters of 1941 represented full production." "The History of Rubber Regulation" also claims that output at these three periods was unrestricted. A glance at the price of export rights in 1937, 1940, and 1941 makes it clear that there was substantial restriction, with export rights worth over one-half of the market price of rubber.

Effect of 100% Excess Profits Tax on Output

The operation of rubber restriction in Malaya in 1941

[16] Holdings, rather than trees, since a prime cause of the decline in yields with age is the loss of stand through disease and windfalls.

[17] P. Lamartine Yates' "Commodity Control" (1943), which purports to give an impartial review of rubber regulation, does not mention the implication of the planting provisions of the scheme and does not refer to the internal division of the quotas or to the under-assessment of the small holders. On the other hand the book states,

"The native, like peasants everywhere, tends to produce more rather than less when the price begins to fall. . . . In general the reaction to a price fall is quite insignificant; indeed, there is no experience to show how low the price would have to fall before native output was seriously curtailed" (p. 115).

These are remarkable propositions. The forward-rising supply curve of small holders' rubber emerged quite clearly during the slump years. For instance, N.E.I., native rubber exports fell from 107,000 tons in 1929 to 61,000 tons in 1932; exports from Sarawak (practically all small holders' rubber) from 11,000 tons in 1929 to 7,000 tons in 1932. Moreover in these territories, as elsewhere in the East, there was a steep rise in the area reaching maturity after 1929 (reflecting the Stevenson boom in the mid-1920's) so that in terms of capacity working the supply was much more elastic than would appear from export or production figures. Small holders' output was substantially curtailed in every important producing territory during the depression. These facts can be ascertained from the most easily accessible sources.

TABLE 9. PRICES OF EXPORTS RIGHTS AND OF COUPONS AND MARKET PRICE OF RUBBER IN THE SECOND MONTH OF EACH QUARTER, 1934-41

	Malaya				N.E.I.			Ceylon	
	Price of Export Rights	Price of Coupons	Singapore Price of Ribbed Smoked Sheet	Estate Rights	Batavia Price of Ribbed Smoked Sheet	Native Coupons	Singapore Price of Medium Blanket	Price of Rights	Colombo Price of Ribbed Smoked Sheet
	Straits ¢ per Pound				Guilder ¢ per ½ Kilo			Rupee ¢ per Pound	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1934									
Aug.	..	9	25	..	23	..	..	21	36
Nov.	..	12	21	..	19	..	..	7	30
1935									
Feb.	*	12	21	*	19	..	¶	19	31
May	*	13	20	*	18	..	¶	19	29
Aug.	*	11	19	*	18	..	¶	20	28
Nov.	*	16	22	*	20	..	¶	23	32
1936									
Feb.	..	20	25	..	22	..	..	29	38
May	..	17	26	..	23	..	..	29	38
Aug.	..	16	27	..	24	..	..	31	39
Nov.	16	16	30	..	34	..	..	34	46
1937									
Feb.	17	20	36	19	39	22	40	32	54
May	11	15	36	13	39	13	38	31	53
Aug.	5	7	30	22	32	15	31	29	44
Nov.	6	8	23	18	25	10	24	24	33
1938									
Feb.	15	14	23	20	23	11	24	25	34
May	11	11	19	16	19	13	18	20	27
Aug.	19	19	27	23	27	18	28	31	39
Nov.	20	22	28	24	28	16	30	31	42
1939									
Feb.	20	21	27	23	28	20	29	32	40
May	21	22	28	24	28	20	29	33	41
Aug.	20	20	28	24	30	13	30	32	43
Nov.	24	23	39	22	36	18	35	24	52
1940									
Feb.	23	22	38	22	33	16	34	23	55
May	22	23	37	23	33	16	34	28	55
Aug.	17	18	37	21	32	13	32	19	55
Nov.	16	19	39	20	34	17	34	28	58
1941									
Feb.	13	18	36	13	30	14	32	19	49
May	9	18	41	8	36	19	38	16	61
Aug.	8†	4	39	3	33	13	34	10	56
Nov.	‡	‡	‡	‡	33	5§	34	1	56

*See Note B (*below*). †July. ‡Not available.
§October. ¶No general individual restriction.

NOTE B:

In official Malayan and N.E.I. terminology, export rights referred to estate export rights, as distinct from small holders' coupons; in Ceylon there was no distinction. The official usage has been followed in the table. In the N.E.I., with negligible exceptions, estate rubber could not be shipped on native rights or *vice versa*. In Malaya there was no complete ban, but for various reasons, rights and coupon were not always fully interchangeable; hence the different sets of prices.

The market in export rights was sometimes narrow, and there were occasional erratic variations (*e.g.*, Ceylon, autumn, 1934), but the quotations shown well reflect the general trend. It will be recalled that the Malayan prices of rights and coupons were up-country quotations. Some 1½-2 cents per pound must be added to these for export duty and transport costs to make these quotations comparable to the Singapore price of rubber.

There are no regular quotations of the price of estate export rights before January, 1937, some sporadic figures are available from miscellaneous sources, and these suggest that in 1934 in Malaya the price of these rights was low, as many estates found it difficult to produce their full exportable amount in that year. In 1935 and 1936 the price of estate export rights was fairly high, both in Malaya and the N.E.I.; 12-16 Straits cents per pound and 14-16 guilder cents per ½ kilo indicate the approximate order of magnitude. Transactions in these rights were, however, on a small scale until the period of high releases in 1937. The purchase in 1935 by the N.E.I. Government of 20,000 tons of rights for cancellation to reduce overexports was an important exception. Some 29 cents per kilo was paid for these rights.

Medium blankets were, of course, quoted in Straits cents per pound, and the price has been converted at the average monthly rate of exchange between the Straits dollar and the N.E.I. guilder.

The Malayan quotations of estate export rights from 1937 to 1940 are from the annual reports of the Controller of Rubber, Malaya. No report was issued for 1941, and the figures represent the transactions of a few large companies to whose records the writer has had access. The prices of estate export rights in the N.E.I. have been taken from the *Economisch Weekblad*. The Ceylon quotations are from the administration reports of the Rubber Controller, Ceylon.

The coupon prices are somewhat approximate. For Malaya the *Malayan Agricultural Journal* frequently published these, but occasionally this information had to be supplemented by reference to various other sources. Moreover, while export rights were transferable between administrations, coupons could be transferred only within each administration (Straits Settlements, Federated Malay States, and each Unfederated Malay State), and there was thus one price for rights, but several prices for coupons, and there were often considerable local variations. The prices given here refer principally to Perak and Johore, and occasionally to Selangor; these States contain the great bulk of the small holdings area in Malaya.

The N.E.I. native coupon prices are the quotations in Palembang and have been taken from the official "Reports on Native Rubber Cultivation" up to May, 1940, and thereafter from the market reports of the Rubber Trade Association of the N.E.I.

It will be noted that at times of high releases (especially 1941), coupons were usually worth more than estate rights, while the reverse ratio held at times of low releases. The former relation reflects the under-assessment of the small holders; the latter is explained by the comparative ease with which the small holders could, at times of lower releases, turn to other products such as rice and coconuts.

TABLE 10. RATE OF PRODUCTION (AS % AGGREGATE STANDARD PRODUCTION) OF MALAYAN ESTATE PRODUCERS, JANUARY-AUGUST, 1941

1941	R.G.A. Estates	Other Estates	All Estates	Internal Rate of Release
Jan.	91.5	95.0	93.1	97.5
Feb.	82.3	93.1	87.4	97.5
Mar.	78.0	87.0	82.2	97.5
Apr.	74.7	86.6	80.3	97.5
May	76.6	95.6	85.5	97.5
June	87.4	95.8	91.1	97.5
July	89.4	97.8	93.9	97.5
Aug.	87.9	98.5	92.9	97.5
Total, Jan.-Aug...	83.6	93.7	88.3	97.5

offers one of the rare opportunities of measuring quantitatively the effect on output of 100% excess profits tax. During the restriction years the Rubber Growers' Association furnished returns to the I.R.R.C. of the costs and outputs of its constituent members. In 1941 the R.G.A. returns for Malaya covered over 90% of the output of the properties owned by sterling companies — *i.e.*, by enterprises liable to the British excess profits tax. By deducting the standard assessments and the production of the R.G.A. estates from the total Malayan estate quota and from the aggregate Malayan estate production, interesting results are obtained, which are summarized in Table 10. There are no data beyond August.

The divergent production trends cannot be attributed to shortages of labor or of materials since the locally owned estates and those owned by sterling companies were equally affected. It is possible to ascertain roughly the relative responsibility of over-assessment and of 100% excess profits tax for the lower rate of production of the sterling companies. During the first half of 1940 (when production is seasonally low owing to wintering) the average internal rate of release in Malaya was 78¾% (the international rate being 80%, with an internal cut of 2½% in the second quarter). Over these six months, when output was not yet affected by 100%

excess profits tax, the R.G.A. estates produced at the rate of 72½% of their aggregate standard production, and all other estates at 77½%, which showed that the R.G.A. estates already found it more difficult to produce the permissible amounts than did the other estates. During the first eight months of 1941, when excess profits tax at 100% was in force, the gap between the performance of the R.G.A. estates and that of the locally owned estates was about 10% of standard production, as against 5% in the first half of 1940, and from this it may be inferred that the two factors (over-assessment and 100% excess profits tax) were about equally responsible in 1941 for the poorer performance of sterling company-owned estates, compared to other Malayan estates. In addition the output of all estate producers was adversely affected by the shortages resulting from the wasteful use of labor and of materials by the sterling companies, encouraged by the **100% excess profits tax.**

Although, as we have seen, output was far from unrestricted in 1941, there developed a substantial shortfall of exports below the permissible levels, which, incidentally, furnished a specious basis for the argument that output was unrestricted. The following table, derived largely from the *Statistcial Bulletin* of the I.R.R.C., summarizes the export deficit up to the outbreak of the Japanese war.

TABLE 11. PERMISSIBLE AND ACTUAL EXPORTS OF RUBBER, JANUARY-NOVEMBER, 1941

	Exports (Thousand Tons)		Deficit	
	Permissible	Actual	Quantity (Thousand Tons)	As % of Permissible Exports
Malaya	611	561	50	8
N.E.I. estates	312	275	37	12
N.E.I. natives	301	304	3	+1‡
Ceylon	99	82	17	17
Sarawak	44	35	9	20
British North Borneo	20	18	2	10
India*	16	2	16	89
Burma	14	9	5	36
Siam	54	43	11	20
Total	1,471	1,329	144†	10

*India was a special case, as her rubber manufacturing industry was developing so rapidly during 1940-41 that she became a net importer of rubber after mid-1941.
†The shipping shortage cannot be held responsible for export deficit. Rubber was a high-priority cargo, and there was no excessive accumulation of port stocks. Moreover Singapore and Penang were outside the export regulation area, and rubber dispatched from the Malayan mainland to these shipping ports counted as export under the regulation scheme.
‡Excess.

The performance of the N.E.I. natives throws some light on the fairness of the quotas. The natives were all the time straining at the leash and would have produced much larger quantities, but under the restriction scheme were unable to do so.

The substantial export deficits of 1941 caused much anxiety in official circles, and in the spring and summer a series of meetings was held in London to consider how supplies could be increased. It was eventually decided to appeal to producers and to their governments to produce more rubber. As, however, these governments were engaged in operating the restriction machinery, and in enforcing international and internal cuts, this appeal was not successful. The restriction machinery was kept in operation to the very end and, indeed, beyond, since in Ceylon it was not abandoned until June, 1942, after energetic representations by the Commander-in Chief, who pointed out that the employes on the staff of the Rubber Controller could more usefully be employed elsewhere. This proposal was unsuccessfully opposed in London. In other territories the machinery operated literally until the arrival of the Japanese. In January, 1942, the restriction authorities in British North Borneo were just in time with their formal report to the I.R.R.C. that on December 31, 1941, there was no abnormal accumulation of stocks (contrary to the provisions of the regulation scheme) on small holdings in that territory. That document was posted some two, or possibly three, days before the conquest of North Borneo by the Japanese. Till the end, restriction was not abandoned; the quotas were not redistributed in favor of under-assessed producers; the employment of labor on replanting was not prohibited; the assessments of producers falling behind with their exports were not reduced; the cost of replanting was not disallowed for taxation purposes; while the assessments on areas cut out for replanting were fully maintained as a bonus for replanting. Very belatedly, toward the end of August, 1941, the rate of release was raised to 120%, and this was followed by a sharp fall in the price of export rights; the issue of coupons and rights was, however, still rigorously maintained.

Summary and Conclusions

Some tentative conclusions are suggested by this brief review. It is, for instance, clear that when full weight is given to the importance of small holdings, ideas of the supply price of natural rubber need drastic downward revision, a point of significance in assessing the measure of assistance which would be necessary to maintain in profitable operation the American synthetic rubber industry in competition with the plantation product.

Wider issues are also raised. As already mentioned, the leaders of the Malayan and of the N.E.I. delegation to the I.R.R.C. were civil servants; the administration of restriction in the East was also in the hands of civil servants. Yet the small holders could hardly have been treated worse if the whole machinery had been operated by estate representatives.[18] Indeed, the "order" which replaced "chaotic competition"[19] was rather like the law of the jungle. One is forcibly reminded of a sentence of Alfred Marshall in his "Principles":

> "In many cases the 'regulation of competition' is a misleading term, that veils the formation of a privileged class of producers, who often use their combined force to frustrate the attempts of an able man to rise from a lower class than their own."

Nor does the outcome serve to confirm the hopes of those who hold that government of industries by trade associations may be made acceptable if they are provided with impartial chairmen. The experience of rubber regulation also emphasizes that when government intervenes in economic affairs, the lack of knowledge of economics on the part of civil servants is likely to prove a serious drawback. The inability to see that output cannot be unrestricted when exports rights are fetching high prices is but one instance among many failures to grasp very simple points.[20]

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[18] An R.G.A. recommendation of 1933 suggests that the small holders might have even fared better under such an administration; cf. footnote [5].
[19] There is no technical reason why competition should be impracticable in the rubber industry. The tiny small holdings are probably the most efficient producers, and even on the estate side the optimum unit would on all reasonable assumptions produce less than 1% of this perfectly standardized commodity.
[20] A remarkable fallacy, which has found its way into many official publications on the rubber industry, blames the transferability and the high prices of export rights for rural unemployment and for the substantial areas left untapped. These were said to be the result of sales of export rights. Yet it is clear that when one person sells rights (and therefore taps fewer trees), someone else must buy them. The rural unemployment and the areas out of tapping reflected, of course, the degree of restriction under the regulation scheme.

"Farrel-Birmingham Equipment News." Farrel-Birmingham Co., Inc., Ansonia, Conn. 4 pages. This issue of the company's news bulletin contains illustrated stories on a calender and lathe to produce uniform rubber thread; a tank washer to clean wild rubber; and a sheeting mill designed to handle production from a No. 11 Banbury.

Available GR-S Polymers[1]

J. L. Brady[2]

AS MOST of you know, Standard GR-S is the all-purpose polymer that carried us through the war, supplementing the national stockpile of natural rubber to the extent of 2,241 long tons in 1942, 181,470 long tons in 1943, 668,840 long tons in 1944, and 754,345 long tons in 1945, at which it constituted 86.6% of the total quantity of elastomer used in the United States. Since most of the decisions concerning the raw materials, the equipment, the reaction conditions, and the polymer to be produced were made at a time when we had no production experience to serve as a guide, and only very limited knowledge of their peculiarities, this record of achievement is amazing. Testimony that the original decisions were sound is found in the fact that no appreciable change in the polymerization formula, or reaction conditions has been required since production began in May, 1942. In addition the progressive replacement of natural rubber with Standard GR-S during that period did not require sacrifice of importance characteristics in the majority of the rubber products—but credit for much of this is due to the rubber compounders and the free exchange of information.

When the task of getting the polymer plants into production had been completed, attention was given to the need of special polymers for applications in which rubber could not be satisfactorily replaced with Standard GR-S or other synthetic polymers then in production. Later this was expanded to include variations found to be promising by the research chemists. To facilitate discussion of the merits and uses of the variations in synthetic rubber in current production, they have been classified according to feature in this paper. Following are the seven groups to be presented.

1. Polymers of different viscosities.
2. Polymers with enhanced tackiness.
3. Non-discoloring, non-staining types of GR-S.
4. Low water absorption polymers.
5. Super-processing polymer.
6. Masterbatches of black fillers.
7. Latices.

Polymers of Different Viscosities

	Polymer Composition	Mooney Viscosity*	Contained Stabilizer
X-317-AC	{ 76.5% butadiene { 23.5% styrene	45	{ Non-discoloring { Non-staining
Standard GR-S	{ 76.5% butadiene { 23.5% styrene	50	{ Discoloring { Staining
GR-S-AC	{ 76.5% butadiene { 23.5% styrene	50	{ Discoloring { Staining
GR-S-85	{ 76.5% butadiene { 23.5% styrene	100	{ Discoloring { Staining

*Mooney large rotor, 4-minute reading 212° F.

STANDARD GR-S. Standard GR-S continues to be the most widely used GR-S polymer, but it is slowly losing that position to some of the variations which are to be described. In recent months the total production of the variations has been close to the 50% mark.

GR-S-AC. The standard coagulant used in GR-S production is salt and acid, or more specifically, a concentrated solution of sodium chloride and a dilute solution of sulfuric acid added to the latex in the order given; the salt to start coagulation and control the particle size of the floc, the acid to complete the coagulation and convert the soap in the polymer to fatty acid. A second method of coagulation in use at the present time employs a solution of alum to precipitate the polymer from the latex. Polymer coagulated with alum is identified by the supplementary designation AC.

This method of coagulation is sometimes used to impart characteristics such as viscosity, stability, or low ash content or water resistance wanted by some consumers, but more often it is used to avoid difficulties in the finishing of polymers which are troublesome to handle in the coagulating and dewatering operations when they are coagulated by the salt and acid technique. X-317 is one of this latter type.

X-317-AC-GR-S. X-317-AC is a 45 Mooney variation made principally for use in chemically blown sponge compounds. In this application it has largely superseded Standard GR-S because it requires less mill mastication and less plasticizer and permits the production of sponge of lower density. X-317-AC has the additional advantages of being pale in color, free from tendency to discolor during exposure to light, and free from tendency to stain cloth, paper, or painted surfaces with which it might be placed in contact in service.

GR-S-85. GR-S-85 is a 100 Mooney variation which was developed to meet the requirements of the asbestos-sheet-packing industry when it was found that Standard GR-S was not a satisfactory replacement for the natural rubber and could not be used without sacrificing important processing and performance characteristics. GR-S-85 permitted the complete replacement of natural with synthetic without loss of processability and manufacturing efficiency. More important, it permitted the production of sheet packings of much better performance quality than could have been made with natural rubber. More recently the use of GR-S-85 has been extended to some types of passenger-car brake lining formerly compounded with natural rubber. Although its use in other products is limited, GR-S-85 offers the advantage of higher strength, resilience, and abrasion resistance if some sacrifice can be made in processability. The graphs (Figure 1) illustrate some of the differences between three polymers of different viscosity.

Polymers with Enhanced Tackiness

	Polymer Composition	Mooney Viscosity*	Contained Stabilizer
GR-S-10	{ 76.5% butadiene { 23.5% styrene	55	{ Discoloring { Staining
GR-S-10-AC	{ 76.5% butadiene { 23.5% styrene	55	{ Discoloring { Staining
GR-S-16 (formerly X-272)	{ 76.5% butadiene { 23.5% styrene	100	{ Slightly discoloring { Slightly staining
GR-S-17 (formerly X-273)	{ 76.5% butadiene { 23.5% styrene	55	{ Non-discoloring { Non-staining
X-274	{ 76.5% butadiene { 23.5% styrene	60	{ Slightly discoloring { Slightly staining
X-304	{ 58% butadiene { 42% styrene	85	{ Slightly discoloring { Slightly staining

*Mooney large rotor, 4-minute reading 212° F.

GR-S-10. In composition GR-S-10 differs from all-purpose Standard GR-S only in that it contains approximately 5% of rosin acid, and Standard GR-S contains an equivalent quantity of fatty acid, both converted from the soaps used to emulsify the hydrocarbons for

[1] Presented at the Nov. 1, 1946, meeting of the Chicago Rubber Group.
[2] United States Rubber Co., Synthetic Rubber Division, Naugatuck, Conn.

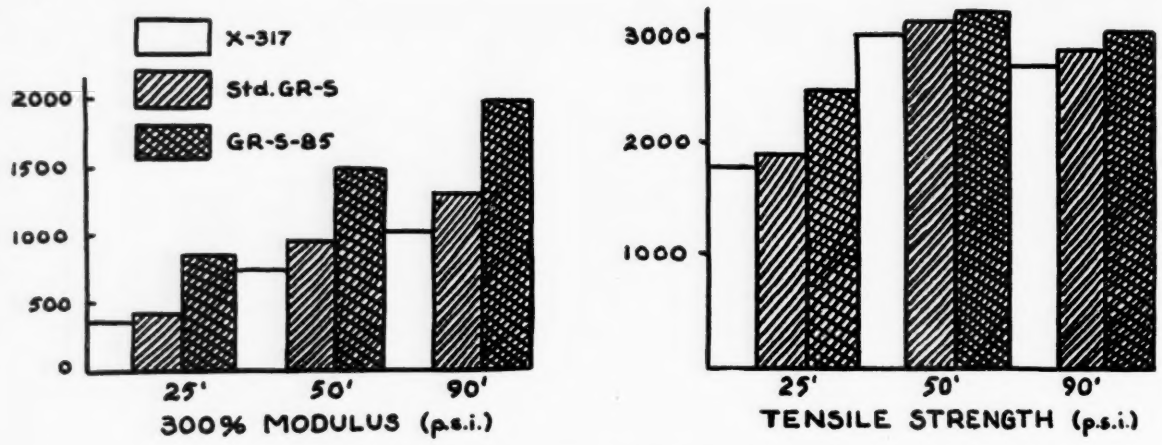


Fig. 1. Comparison of Physical Properties of Three Polymers of Different Viscosities

the polymerization reaction. In properties there is a greater difference; GR-S-10 is the better of the two in many compounds. The following advantages were found to be gained through its use by our tire plants—

1. 20% increased Banbury output through the use of concentrated masterbatches. This method of compounding was not possible with Standard GR-S because the masterbatches were dry and crumbly and not so easy to handle on the batchoff mill.

2. Better adhesion of the calender coat to the solutioned fabric before vulcanization has given many savings. There is less "peeling" of the calender coats in the fabric cutting and tire building operations, less fabric scrap, fewer raw tires to repair because of separations occurring during shaping, and an increase of 10-15% in calender efficiency as coating can be done at higher speed. GR-S-10 compounds are also better for friction coating; they adhere more strongly to the calender roll and do not sheet off on the fabric.

3. Greater tackiness for laminating and splicing, particularly in compounds containing natural rubber.

4. Better ply-separation resistance. Improved ply-separation resistance of the order of 50-60% is indicated by the results obtained in wheel and road tests.

5. Higher heat-break resistance. Carcass compound with GR-S-10 runs cooler and is more resistant to shock.

6. Better abrasion and crack-growth resistance in tread compound. Road tests have indicated 5-10% improvement in wear with fewer groove cracks. This difference in cracking and crack growth may be retained or converted to additional wear resistance by compounding changes.

The value of GR-S-10 is not limited to tires. It offers advantage in the compounding of many products such as soles and heels, conveyer and power transmission belts, bicycle tires, hose, etc.

In shoe soles and heels it gives better abrasion resistance and higher tensile strength without sacrifice of resilience, tear resistance, or other important cured properties.

In conveyer and power transmission belt compounds the replacement of Standard GR-S with GR-S-10 increases calender efficiency, gives greater tackiness for laminating, reduces building labor requirements, and improves service life.

In bicycle tire compounds it gives advantages similar to those found for passenger tire compounds: namely, improved mixing and calendering efficiency, reduced fabric scrap, greater tackiness for laminating and splicing, and somewhat better wear in service.

In hose friction compounds it gives the advantage of easier calendering and greater tackiness for product building. Performance quality is equal to or slightly better than that of compounds made with Standard GR-S.

GR-S-10-AC. GR-S-10-AC differs from GR-S-10 only in that it is a few points higher in Mooney viscosity and is coagulated from the latex with alum solution rather than with the standard salt and acid solutions. GR-S-10-AC is made principally to fit the equipment and processing conditions of one tire manufacturer. No information is available at this time regarding its merit, but it is believed to be better than GR-S-AC in many of the ways in which GR-S-10 is better than Standard GR-S.

GR-S-17. This polymer is a non-discoloring non-staining variation of GR-S-10 especially made for use in white and light-colored compounds which are required to retain their brilliance throughout life, and for all compounds which are required to be free from tendency to stain surfaces with which they may come in contact in service. Its similarity to GR-S-10 in properties and freedom from discoloring and staining tendencies make it valuable in the compounding of white-sidewall tires, white and light-colored shoe soles and heels, electric lamp cord, many mechanical goods, hospital sheeting, etc.

X-274-GR-S. X-274-GR-S is intermediate between GR-S-17 and GR-S-10 in discoloring and staining tendencies. It is intended for use in compounds in which a high degree of color stability and complete freedom from staining tendency are required.

GR-S-16. Rosin polymer is also available in a higher viscosity under the Rubber Reserve designation GR-S-16. This modification made its first appearance as X-40-GR-S on December 28, 1943, when the Naugatuck polymer plant completed the production of two batches. Since that time substantial quantities have been produced by the Institute plant under the designation X-272-GR-S for use in the compounding of adhesives and pressure-sensitive tapes.

Following are explanations of four of the advantages to be gained from the use of GR-S-16 in this application.

1. Much higher raw strength. High raw strength or cohesiveness is necessary to prevent transfer of the adhesive film from one surface to another and to give bonds which will not break when subjected to continuous low stresses.

2. Contains no fatty acid to bloom to the surface of the adhesive film and reduce its surface tackiness.

3. Non-discoloring. The stabilizer in GR-S-16 is low in discoloring tendency and does not darken appreciably during prolonged exposure to light. This is of importance in transparent-back tapes, stationery adhesives, and the like.

4. Low in electrolyte content. This is an important consideration in tapes made for electrical applications in which the adhesive will be in contact with corrosible metal surfaces. X-272-GR-S is low in soluble soap and ash which would cause corrosion.

GR-S-16 is made principally for use in unvulcanized form, but may also be used in compounds which are vulcanized. Because of the high initial viscosity of GR-S-16, compounds would be more difficult to process than those of GR-S-10 or GR-S-17, but if some sacrifice in processibility can be made, the advantage of higher strength, resilience, and abrasion resistance can be gained. GR-S-16 is intermediate between GR-S-10 and GR-S-17 in discoloring and staining tendency.

X-304-GR-S. Like GR-S-16, X-304 is made principally for use in the compounding of adhesives and pressure-sensitive tapes. The advantages to be gained from the replacement of Standard GR-S or GR-S-10 with X-304 are similar to those given for replacement with GR-S-16; raw strength is good, and the polymer contains no fatty acid to bloom to the surface and reduce its tackiness. X-304, however, is not quite so good as GR-S-16 in color stability when exposed to light. X-304 cannot be used in electrical tapes as it contains appreciable quantities of electrolytes which would cause corrosion.

Non-Discoloring, Non-Staining Types of GR-S

	Polymer Composition	Mooney Viscosity*	Contained Acid	Rate of Cure
GR-S-25	76.5% butadiene, 23.5% styrene	50	Fatty acid	Slower than Standard GR-S
GR-S-17	76.5% butadiene, 23.5% styrene	55	Rosin acid	Slower than Standard GR-S-10
X-274	76.5% butadiene, 23.5% styrene	60	Rosin acid	Slower than Standard GR-S-10
X-317-AC	76.5% butadiene, 23.5% styrene	45	Fatty acid	Slower than Standard GR-S
GR-S-40-AC	58% butadiene, 42% styrene	45	Fatty acid	Slower than Standard GR-S
X-344	76.25% butadiene, 23.25% styrene, 0.5% crosslink	55	Fatty acid	Requires sulfur adjustment

*Mooney large rotor, 4 minute reading, 212° F.

GR-S-25. GR-S-25 is a non-discoloring, non-staining variation of Standard GR-S especially made for use in white and light-colored compounds which are required to retain their brilliance throughout life, and for all compounds which are required to be free from tendency to stain fabric, paper, paint, enamel, or lacquer surfaces with which they may come in contact in service. Its very pale color and complete freedom from materials which can cause stain or discoloration make it ideal for numerous products such as white-sidewall tires, white and light-colored shoe soles and heels, mottled floor tile, cable on electrical household appliances, upholstery, tubing, door bumpers and gaskets, and hospital sheeting, to name just a few. In these applications it has largely superseded GR-S-50, which is darker in color and also semi-discoloring and staining.

GR-S-17. This polymer was described in the section dealing with rosin polymers; so it will be touched lightly at this time. GR-S-17 is the complement of GR-S-10 as GR-S-25 is the complement of Standard GR-S. We believe that GR-S-17 is preferable to GR-S-25 in most compounds, particularly those reinforced with minimum quantities of fillers, or made for use in dynamic service.

X-274-GR-S. X-274 is similar to X-273, but not so pale in color or so free from tendency to cause discoloration or stain.

X-317-AC-GR-S. X-317-AC-GR-S is a polymer made principally for use in chemically blown sponge compounds to—

1. Reduce mill mastication requirements, increase mill capacity, reduce labor and power costs.
2. Facilitate blow to lower densities.
3. Obtain good colors with minimum concentrations of pigment. X-317-AC is pale in color and required only small amounts of pigment.
4. Obtain color stability. X-317 is non-discoloring.
5. Improve resilience of the sponge.
6. Obtain freedom from staining tendency. X-317 compounds will not stain paper, cloth, or painted surfaces with which they may be in contact in service.

GR-S-40-AC. Relative to the other GR-S polymers, GR-S-40 is a high styrene polymer; the ratio of styrene combined with butadiene is nearly twice that of the other GR-S polymers. This difference in composition gives GR-S-40-AC more thermoplasticity before cure, and higher modulus, tensile strength, and hardness after cure. These differences and the advantages that they give in compounding are not so apparent in laboratory evaluations as in factory evaluations because of the leveling effect of the mastication given to the mixes by the laboratory mill. GR-S-40-AC is being used at present as part of the elastomer in shoe sole and heel and in electrical wire insulating compounds. In the former it smooths out the calender strip from which the uncured blanks are cut and makes it easier to control the weight of the blanks. In wire insulation it increases the rate of extrusion and the surface smoothness of the coating.

GR-S-40-AC also has value in the compounding of adhesives to raise the raw film strength.

X-344-GR-S. X-344-GR-S will be discussed later as the non-discoloring, non-staining complement of GR-S-60 intended for use as part of the elastomer in applications in which smooth calendering or extrusion and freedom from shrinkage are required. Applications such as footwear, electrical wire insulation, and handmade sundries in which surface appearance or retention of embossed design or retention of shape or resistance to press-marking is required have found it advantageous to use X-344-GR-S for part of the elastomer. The advantages are not limited to GR-S compound. Much of it is being used at the present time in natural compounds.

Low Water Absorption Polymers

This quality in the polymer can be obtained by coagulation with acid without salt or by coagulation with alum. The available polymers prepared by each of these methods of coagulation are given below:

Coagulated With Acid Without Salt

	Polymer Composition	Mooney Viscosity*	Contained Acid	Contained Stabilizer
GR-S-65	76.5% butadiene, 23.5% styrene	50	Fatty acid	Discoloring, Staining
GR-S-16	76.5% butadiene, 23.5% styrene	100	Rosin acid	Slightly discoloring, Slightly staining

*Mooney large rotor, 4 minute reading, 212° F.

Coagulated With Alum

	Polymer Composition	Mooney Viscosity*	Contained Acid	Contained Stabilizer
GR-S-AC	76.5% butadiene, 23.5% styrene	55	Rosin acid	Discoloring, Staining
GR-S-10-AC	76.5% butadiene, 23.5% styrene	55	Fatty-acid	Discoloring, Staining
X-317-AC	76.5% butadiene, 23.5% styrene	45	Fatty acid	Non-discoloring, Non-staining
GR-S-40-AC	58% butadiene, 42% styrene	45	Fatty acid	Non-discoloring, Non-staining

*Mooney large rotor, 4 minute reading, 212° F.

Salt and acid are the coagulants used in the preparation of Standard GR-S and all variations of GR-S not requiring special techniques either to facilitate finishing in the polymer plant or to impart special properties to the polymers. Since this technique of finishing unavoidably leaves about 0.2% soap and 0.9% ash in the polymer unless the fresh coagulum is given special handling as in the U.S. Rubber Co. plant at Naugatuck, it is not satisfactory for the finishing of polymer used in electrical wire insulation, in steam hose and some types of water hose, in hydraulic packings, in tank linings and other products in which freedom from electrolytes or water absorbent matter is necessary for good performance in service.

GR-S-65. GR-S-65 was developed to meet these requirements without losing any of the good characteristics of salt-acid coagulated polymer. GR-S-65 is essentially Standard GR-S low in electrolyte and soluble soap. It is coagulated from standard latex by a special technique and leached before drying to eliminate much of the electrolyte resulting from conversion of the soap. Soap content of GR-S-65 is close to zero, and electrolyte content is less than one-fifth that in Standard GR-S. The following tables show this more clearly. The first table gives the soap and ash contents of representative lots of GR-S-65 and other polymers and shows the effect of these on water absorption resistance. The second table gives the results obtained in a prolonged immersion test and further indicates the merit of GR-S-65 in applications in which resistance to water absorption is required.

	Soluble Soap Content	Total Ash Content	Water Absorption* Uncured Polymer 20 Hours, 158° F.
GR-S-65	.02%	.16%	1.25 mg/sq. cm.
GR-S-AC	0%†	.57%	2.41 mg/sq. cm.
Std. GR-S, Naugatuck	.21%	.40%	4.13 mg/sq. cm.
Std. GR-S, sources other than Naugatuck	.21%	.92%	5.13 mg/sq. cm.

*Test made according to Rubber Reserve specification for wire and cable industry polymer.
†Soap in GR-S-AC is an aluminum soap which is not soluble.

Water Absorption during Prolonged Immersion at 158° F.

	3 Days' Immersion Uncured Polymer	50 Days' Immersion Uncured Polymer
GR-S-65	2 mg/sq. cm.	10 mg/sq. cm.
GR-S-AC	3 mg/sq. cm.	16 mg/sq. cm.
Rubber, smoked sheet	4 mg/sq. cm.	20 mg/sq. cm.
Std. GR-S, Naugatuck	7 mg/sq. cm.	24 mg/sq. cm.
Std. GR-S, other sources	10 mg/sq. cm.	38 mg/sq. cm.

The value of the lower soluble matter content and the greater resistance to water of GR-S-65 in electrical insulation is indicated by the date in the following tables. They were obtained in an evaluation made in RW code building wire compound. Comparison was made with Naugatuck Standard GR-S as that polymer was the one in general used by the wire and cable industry at the time the evaluation was made.

Specific Inductive Capacity

	SIC Original Value	% Gain 1 Day to 14 Days	% Gain 7 Days to 14 Days
GR-S-65	4.97	4.4%	2.2%
Std. GR-S, Naugatuck	5.24	3.8%	1.9%
Specification limits for RW code	6.0	10% maximum	3% maximum

Although the % gain in inductive capacity during immersion was slightly greater for GR-S-65 compounds even after 12 weeks' immersion, the SIC values are definitely lower than those for Naugatuck Standard GR-S compounds.

Insulation Value

Megohms/100 Feet of RW Building Wire

	Immersed 2 Weeks at Room Temperature	Immersed 2 Weeks in Hot Water
GR-S-65	11,000	1,200
Std. GR-S, Naugatuck	2,500	600

GR-S-65 insulation is four times as good if comparison is made at room temperature and two times as good if comparison is made at elevated temperatures.

Power Factor Stability

#14 AWG Copper Conductor 3/64 Conductor Insulation Difference between % PF @ 80 Volts/Mil and @ 40 Volts/Mil.

	1-Day Immersion	7-Day Immersion	28-Day Immersion
GR-S-65	.66	.83	.91
GR-S-AC	.92	1.00	1.34
Std. GR-S, Naugatuck	1.88	2.03	3.25

Other properties important from the standpoint of specification or performance are substantially the same for GR-S-65 as for Standard GR-S.

GR-S-16. Like GR-S-65, GR-S-16 is coagulated by subsurface atomization of the latex in dilute sulfuric acid and leached before drying to remove most of the electrolyte remaining from conversion of the soap. Many of the applications in which GR-S-16 is used do not require it to be low in electrolyte, but a few of them do, and since acid flocculation is satisfactory for both, all the polymer required is made by the same technique. The water soluble matter in acid flocculated GR-S-16 is in the range of 0.2%, which is low enough to be satisfactory for pressure-sensitive tapes used on electrical equipment. The more important characteristics of GR-S-16 and the advantages to be gained from their utilization were discussed in the section dealing with polymers of enhanced tackiness.

GR-S-AC. Because it is low in electrolyte and soluble soap content GR-S-AC also finds some use in electrical wire and cable insulation steam hose, and other applications in which contained water absorbent matter may lead to premature failure in service. In these applications it has been largely superseded by GR-S-65 as the latter is better processing and equal to or better in most cured properties.

GR-S-10-AC. Alum coagulated rosin polymer is available under the designation GR-S-10-AC for compounders wanting the characteristics of both the resin polymer and alum coagulation. This polymer was described in the section dealing with polymers with enhanced tackiness.

X-317-AC-GR-S. X-317-AC is one of the alum polymers by necessity rather than by choice; alum coagulation is required to facilitate handling in the coagulating and dewatering operations to offset the effect of the lower viscosity of the polymer. X-317-AC is the only available alum polymer protected with non-discoloring and non-staining stabilizer. Its principal use is in chemically blown sponge, but it can be used in any compound in which polymer of low initial viscosity is wanted.

GR-S-40-AC. GR-S-40-AC is also one of the alum polymers of necessity. The merits of this polymer were previously discussed in the section concerned with non-discoloring non-staining polymers. For convenient reference they are enumerated in tabular form below—

1. In adhesives and in combining compounds GR-S-40-AC gives increased film strength.
2. In shoe sole and heel, and in wire insulating compounds it gives smoother calendering, smoother extrusion, higher modulus and tensile strength, and increased cured hardness.

Super-Processing Polymers

	Polymer Composition	Mooney Viscosity*	Contained Acid	Contained Stabilizer
GR-S-60 (formerly X-285)	76.25% butadiene 23.25% styrene 0.50% cross-link	55	Fatty acid	Discoloring
X-344	76.25% butadiene 23.25% styrene 0.50 cross-link	55	Fatty acid	Non-discoloring Non-staining

*Mooney large rotor, 4 minute reading, 212° F.

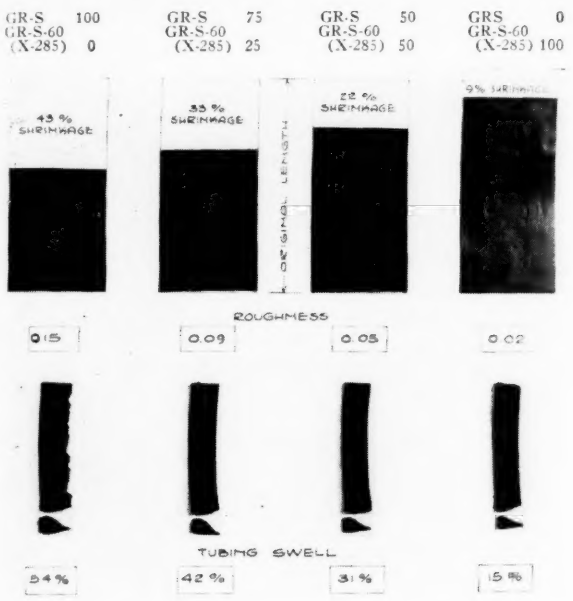


Fig. 2. Improved Processing with GR-S-60 (Formerly X-285) Type Blends

GR-S-60. The poor processability or more specifically, the nerviness of GR-S has long been recognized as one of its shortcomings, and numerous investigations have been made to find ways of reducing it. As is well known, calendered sheets and extruded ribbons of either raw or compounding polymer are rough in surface appearance and tend to shrink after they have been formed, and if the restraining force is enough to prevent the shrinkage, numerous breaks are likely to occur whenever there are imperfections in the sheet or ribbon. This deficiency may be masked by compounding the polymer with large quantities of filler and plasticizer, but usually not without sacrificing qualities important in the fabrication or performance of the finished product, and until recently there was no alternative. Now there is. The investigations in polymerization have produced a new polymer which exhibits vastly improved processing characteristics. This polymer has the Rubber Reserve designation GR-S-60 (formerly X-285). GR-S-60 is essentially Standard GR-S to which a small quantity of a cross-linking agent has been added during polymerization. This addition greatly reduces the nerve in the polymer and makes it possible to compound with normal quantities of filler and plasticizer. GR-S-60 is purposely made with more cross-linking agent than is required for the average compound to give latitude to the compounders in several branches of the industry. It is recommended that it be used as part of the elastomer rather than as all of the elastomer unless a high degree of surface smoothness and freedom from shrinkage are required. Some adjustment of sulfur and accelerator is usually necessary if the GR-S-60 is used for a large part of the elastomer, as GR-S-10 is lower in unsaturation and required less sulfur. The superior processing characteristics of GR-S-60 permit the use of more strongly reinforcing fillers and/or higher viscosity with attendant improvements in finished product quality. It also permits reduction in Banbury or plasticator mastication since the function of that operation is largely one of improving processability. The accompanying illustration (Figure 2) indicates the improvements in processing to be gained by the substitution of GR-S-60 for part or all of the elastomer in a tread-type compound. The bar graphs (Figure 3) show the physical properties of the vulcanizates. With reduced sulfur in the compounds containing GR-S-60, the modulus, tensile, and elongation values closely approach those of the Standard GR-S compound particularly after aging. This also applies to compounds containing non-black fillers as well as to compounds containing carbon black.

X-344-GR-S. GR-S-60 is available in non-discoloring non-staining form under the Rubber Reserve designation X-344-GR-S. Properties other than color stability parallel those of GR-S-60.

Masterbatches of Blacks

	Ratio of Filler/Polymer	Filler	Polymer
Black 1	50/100	EPC Black	Std. GR-S except 40 Mooney
X-337	50/100	EPC Black	4:1 mixture GR-S-10 and Std. GR-S of 35 Mooney viscosity
X-334	50/100	HMF Black	Same polymer as in X-337
X-335	25/100	HMF Black	Same polymer as in X-337
X-336	40/100	SRF Black	Same polymer as in X-337

Black-1-GR-S. Black-1-GR-S is produced only by the General Tire & Rubber Co., Baytown, Tex., plant at the present time, but a second plant may be commissioned to make it as the demand for it is considerably greater than the production capacity of the Baytown

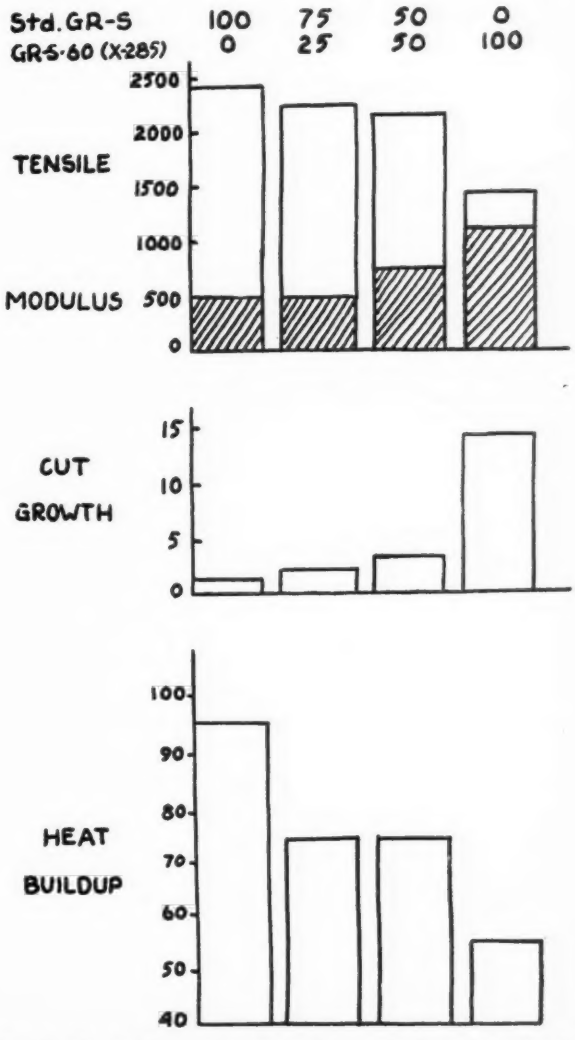


Fig. 3. Physical Properties of Blends of GR-S-60 and Standard GR-S Compounded in Rubber Reserve Control Test Recipes 60-Minute Cure

plant. Present production of masterbatch is about 10,000,000 pounds/month. The following advantages have been found to be gained through its use in passenger-tire-tread compound—

1. Reduced mixing time which increases Banbury capacity approximately 50% if comparison is made with Banbury mixes compounded with plasticated or premasticated GR-S. If comparison is made with unpremasticated GR-S, the saving is greater.
2. 5-10% better wear resistance.
3. Better crack-growth resistance which may be retained or converted to improve tread wear by compounding changes.
4. Lower compound cost as indicated below—

	Banbury Mixed	Black-1-GR-S
GR-S 3½ lb. @ 18.5¢	$0.1233	$0.1467
EPC Black ½ lb. @ 5.5¢	.01833	
Transportation of GR-S	.00333	.0050
Transportation of black	.00443	
Plasticating and mixing labor	.00163	....
Plasticating and mixing power	.00200	....
Masterbatch cost	$0.1530	$0.1517

5. An incidental, but not unimportant effect of the use of Black-1 is the increased cleanliness of the mixing department resulting from the part or complete elimination of loose black.

X-337-GR-S. X-337-GR-S is a masterbatch of EPC Black in a 4:1 blend of rosin acid and fatty acid polymers having a Mooney viscosity of 35 before compounding with black. At the present time it is produced in only limited quantity by the General Tire Baytown plant, but it is probable that production will be expanded when additional facilities for the preparation of black masterbatch become available. X-337-GR-S offers the advantages of better wear resistance and better crack-growth resistance.

Final results of road test evaluation in passenger-tire-tread stock are not available, but preliminary results indicate wear resistance to be 5-10% higher than that obtainable with Black-1-GR-S and 10-15% higher than that obtainable with Banbury mixed masterbatch. Crack-growth resistance is slightly higher for the X-337-GR-S compound than for the compounds made with Black-1-GR-S or with Banbury mixed masterbatch. X-337-GR-S also gives the advantages of lower compound cost and increased Banbury capacity. Increased millroom cleanliness and better working conditions also follow from the use of X-337-GR-S.

X-334, X-335, X336 GR-S. At present these masterbatches are obtainable only in experimental quantities for the reasons given in the above paragraph. If the evaluations indicate advantage, these and others will be made in production quantities when the equipment installations planned for the Port Neches and Los Angeles plants are ready for operation.

Latices

Until recently high-solids synthetic latices could be made only by the costly and time-consuming operation of concentrating dilute latex. It is now possible to produce stable fluid latices of 55-60% solids content directly in the reactor. Average particle size approaches that of natural rubber latex, and mechanical stability is excellent.

Laboratory tests indicate that films from high-solids are equivalent to those from creams of regular latices of the same type. Since the equipment changes required for the production of high-solids latices are relatively simple, this development will relieve the latex consumer of part of the premium which must be paid for concentrated latices at present. Both Type II and Type III are available in high-solids form under the Rubber Reserve designations X-308 and X-271, respectively. Some of the properties of these latices are given below in tabular form.

As indicated in the table, the properties of the polymers in X-308-GR-S and X-271-GR-S are substantially the same as those in the regular Type II and Type III latices.

X-271 or Type III is recommended for applications in which good tensile strength is required and high cold-resistance is not important. For applications in which good cold-resistance is required and tensile strength can be sacrificed, X-308-GR-S or Type II should be used.

Other modifications of Type II and Type III latex, both normal and high concentration, are available under the following designations—

X-230. Same as Type III except for concentration. Solids content 39-44%.

X-270. Similar to X-271; a Type III of 55-60% solids.

X-276. Similar to X-308 and X-333. A type II of 55-60% solids.

X-293. Similar to Type II except made to yield a polymer of low viscosity. This latex is used in a special adhesive compound.

X-299. Same as Type II except for concentration. Solids content 27-31%.

Similar to X-276 and X-308; a Type II of 50-60% solids.

(The work reported in this paper was carried out under the sponsorship of the Office of Rubber Reserve, Reconstruction Finance Corp., in connection with the Government Synthetic Rubber Program.)

PROPERTIES OF SOME SYNTHETIC LATICES

	Regular, Type II	X-308-GR-S, High-Solids, Type II	Regular, Type III	X-271-GR-S, High-Solids, Type III
Polymer composition	76.5% butadiene, 23.5% styrene	75.0% butadiene, 25.0% styrene	54.0% butadiene, 46.0% styrene	54.0% butadiene, 46.0% styrene
Solids in latex	26-28%	55-60%	37-39%	50-60%
Viscosity of latex in centipoise	8	17	7	40
pH	8.5-9.25	8.5-9.25	10-11	9.5-11.5
Average particle size	925 Å	2080 Å	1125Å	2130 Å
Mechanical stability	high	high	high	high
Dilution stability	Dilution will not cause coagulation	Additional stabilizer required if diluted to 15%.	Dilution will not cause coagulation	Additional stabilizer required if diluted to 15%
Emulsifier	Fatty acid soap	Rosin soap fatty acid soap and an alkaryl sulfonate.	Rosin soap	Rosin soap and an alkaryl sulfonate.
Storage stability	Good	Good	Good	Good
Tensile strength at best cure*	300 p.s.i.	300 p.s.i.	2100-2300 p.s.i.	2100-2500 p.s.i.
Color stability of dry films	Discoloring	Non-discoloring	Non-discoloring	
Selling price,† drum lots	$0.250/lb. (dry)	$0.2675/lb. (dry)	$0.250/lb. (dry)	$0.2675/lb. (dry)
Selling price,† car lots	$0.185/lb. (dry)	$0.2025/lb. (dry)	$0.185/lb. (dry)	$0.2025/lb. (dry)

*Tensile strength of films laid from the latex (compounded for vulcanization).
†Transportation charge is $0.005/lb. (dry weight) for carload lots, $0.01/lb. (dry weight) for less-than-carload lots.

Methods for Evaluating New Diene-Type Polymers[1]

A. E. Juve[2] and C. H. Schroeder[2]

THE procedure to be used in the evaluation of a new polymer is determined by the size of the sample available and by the objective in mind when the polymer was prepared. It is obviously impossible to evaluate completely a laboratory prepared polymer because only an insufficient quantity usually is available to conduct the extensive tests in the necessary variety of recipes. In a sense the evaluation of any rubber, no matter on what scale it is being produced, is never complete as long as advances in compounding techniques are being made.

It is necessary, therefore, to pick certain critical tests in a single recipe, or at the most in several recipes, to determine whether or not an improvement has been made in the properties being measured. If the purpose for which the polymer was prepared was to effect an improvement in processing characteristics or a reduction in the ash content of the rubber or an improvement in low temperature performance or for the improvement of any other specific property, a set of critical tests should be selected in each case which will indicate whether or not an improvement has been made. At the same time some assurance must be sought that in accomplishing the objective other important properties have not been sacrificed.

The discussion which follows is based on the assumption that the quantity of polymer available is between 40 and 1,000 grams and that the objective in preparing the polymer is to effect a general improvement in the resistance to crack growth or of flexing for stocks having high rebound or low hysteresis, physical properties at elevated temperatures, properties in pure gum formulations, hysteresis, resistance to tear, and tack of GR-S.

The recipes and tests are chosen to measure, directly whenever possible, prescribed properties whereby an estimate can readily be made of the extent of the improvement. It is also necessary to be certain that in effecting an improvement over GR-S in one or another of these properties, no important sacrifice has been made in some other property. For example when the ratio of monomers is changed, the low temperature flexibility may be altered, thus making it necessary to reinvestigate this property.

Likewise observations on processability should be made to the extent permitted by the sample size. Laboratory methods for estimating the processability of polymers have been described by White, Ebers, and Schriver,[3] and no additional discussion of them will be included here.

Selection of Test Recipes

The considerations to be observed in selecting a test recipe are as follows:

(1) The recipe should be similar to those in which the rubber might be used in regular production. For example a tread test recipe should resemble a typical production tread recipe.

(2) The recipe should not be so heavily loaded with pigments and softeners that differences in polymers will be obscured.

(3) The recipe should be suitable for a wide variety of polymers.

(4) The recipe should not contain ingredients whose proportions are so critical that normal errors in weighing by non-technical assistants will interfere with the reproductibility of results.

(5) The change in properties with progressing cure should be such that comparable states of cure can be readily recognized.

The essentials of a typical tread-type recipe are given below:

TYPICAL TREAD-TYPE RECIPE

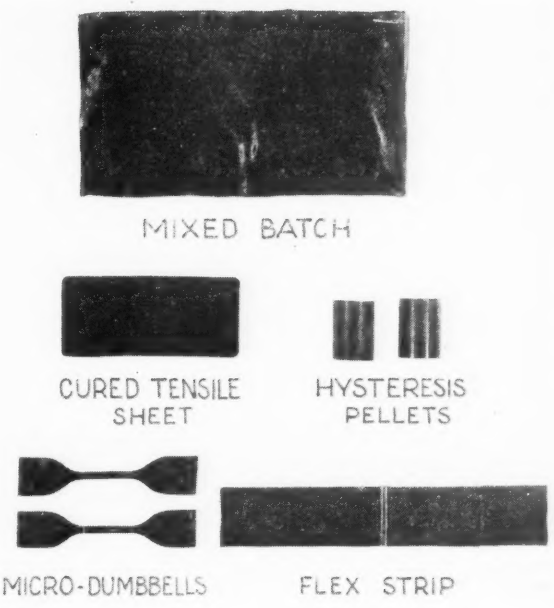
Polymer	100* parts by weight
Carbon black	40-50
Sulfur	1-3
Accelerator and activator	Various kinds and amounts
Softener	5-10

*It is recognized that the practice of prescribing 100 parts of polymer does not mean that 100 parts of elastomer are present since varying amounts of fatty acids, stabilizers, etc., may be contained in the sample. However this procedure obviates the necessity of determining the elastomer content by analytical means and also conforms to generally accepted commercial practice.

The type of carbon black almost universally employed at present is EPC (easy processing channel) black. The proportion used is usually in the 40-50-part range, which is the range used in production tread recipes.

The proportion of sulfur required for the optimum properties depends upon the accelerator used and the characteristics of the polymer. In general the more active accelerators require less sulfur than the less active ones, and the tougher, higher molecular weight polymers, less sulfur than the softer, lower molecular weight ones.

The softeners most commonly used are the coal-tar



Small Test Sheet and Test Specimens Obtained from It

[1] This article is based on work done for the Office of Rubber Reserve under the government synthetic rubber program.
[2] B. F. Goodrich Co., Akron, O.
[3] *Ind. Eng. Chem.*, 37, 767 (1945).

types (e.g., BRT#7), oil refining residues (Paraflux, Naftolen, Dutrex, etc.) and wood products (pine tar, wood rosin, gum turpentine, etc.).

The latter group constitutes strong retarders of vulcanization because of their acidic character, and their use necessitates adjustment in the recipe to overcome this effect. The possibility that the retarding effect may not be the same for different lots from the same or different suppliers should not be overlooked.

For ease of handling small quantities by non-technical assistants and mill operators, the melting point of the softener should be considered. Solid materials which require heating to facilitate weighing and incorporation on the mill are time-consuming when many polymers are being handled so that a liquid softener is the better choice.

The amount used should be sufficient to facilitate mixing, but not so much that polymer differences are likely to be obscured. The amount usually used ranges from five to ten parts.

The accelerator and activator should be selected after consideration of the following factors:

(1) They should be similar to those used in production recipes unless there is reason to believe that a radically different acceleration is required.

(2) They should be suited to the widest possible variety of polymers.

(3) They should give stress-strain *vs.* time of cure curves which permit the ready selection of comparable states of cure.

(4) They should be as insensitive as possible to small errors in weighing.

(5) They should provide an adequate rate of cure.

Nearly all organic accelerators function best in the presence of an inorganic oxide. For this purpose zinc oxide is almost universally used to the extent of 2.5 to five parts. Rarely, magnesium, calcium, or lead oxides may be used for this purpose.

A combination of ten parts of litharge and five parts of zinc oxide with no organic accelerator has given very satisfactory results with a wide variety of rubbers. A small error in weighing is not critical, which is an important advantage in evaluating very small quantities of rubber. However this type of acceleration is not used in commercial products, and for this reason it may be objectionable for evaluation work.

The most commonly used accelerators in evaluation work are 2-mercaptobenzothiazole, 2,2′ benzothiazyl disulfide, benzothiazyl sulfenamide, B.J.F., (phenylaminomethyl 2-benzothiazyl sulfide), tetramethylthiuram monosulfide, and mixtures of these with secondary accelerators such as DPG, DOTG, 808, or Butene. In general the proportions used and the selection of the particular accelerator or combination are determined by the desired speed of cure. 2-mercaptobenzothiazole and 2,2′ benzothiazyl disulfide by themselves are objectionable because they are too slow at the temperatures ordinarily used and cause difficulty in the selection of comparable cures. The activators used with 2-mercaptobenzothiazole or 2,2′ benzothiazyl disulfide are used in such small proportion that the possibility of wide variations due to small errors in weighing enter into consideration. The latter argument also applies to tetramethylthiuram monosulfide which, when used as a primary accelerator, is used in about one-fourth the concentration required for 2-mercaptobenzothiazole, 2,2′ benzothiazyl disulfide, benzothiazyl sulfenamide, or B.J.F.

Possibly nine-tenths of all evaluation work on GR-S-type polymers has been done on tread-type recipes. This practice results from their great importance commercially and also because they give nearly the maximum stress-strain properties obtainable. This in turn permits the observation of differences and trends in polymer quality which might be obscured in low tensile stocks. One should not overlook the possibility that the strong reinforcing effect of the carbon black may mask the ability of a polymer to produce superior pure gum or lightly loaded vulcanizates. In the case of at least two synthetics, GR-M (neoprene) and GR-I (Butyl) the tensile strength of tread-type stocks is no better than that of the pure gum stocks. With rubbers such as these, evaluations in a tread-type recipe only might miss their excellent pure gum properties.

There are some advantages in the use of about half the quantity of carbon black commonly employed in the tread-type recipe. The possible improvement in pure gum quality is not completely masked by this amount of carbon black, and the properties are enough better than those of an unloaded stock that satisfactory test results can be obtained. Also this type of compound is similar to those used for carcass and inner tube work. For such a recipe the quantity of softener should also be cut in half.

A further step in which the carbon black and softener are both omitted would give a pure gum-type recipe, the use of which has not been indicated with existing diene polymers.

Compounding and Mixing Technique

Various devices have been evolved in the different laboratories for handling the several compounding materials accurately and expeditiously. The following points represent the technique used in the Goodrich laboratories and may or may not correspond to the practice in other laboratories.

Rubbers and pigments weighing more than five grams are weighed to the nearest tenth of a gram on a beam balance or torsion balance. Smaller amounts are weighed to the nearest five milligrams on an analytical balance or 10 milligrams on a torsion balance.

To improve the accuracy of weighing and to aid in the incorporation of dry powders, masterbatches consisting of a high concentration of the powder in a standard GR-S are used. A typical recipe might be as follows:

TYPICAL RECIPE USING MASTERBATCHES

Polymer	92.6 parts	
EPC black	50	
Accel. masterbatch	6	(20% accel. 80% GR-S)
ZnO masterbatch	6.25	(80% ZnO 20% GR-S)
Sulfur masterbatch	3.33	(60% sulfur 40% GR-S)
Softener	10	
Stearic acid	1.5	

This results in the introduction of less than 10% of GR-S into the rubber being examined. Unless the rubber is radically different in composition from GR-S, this cannot be detected in the cured properties.

In handling small quantities of softeners it is frequently found advantageous to dissolve the softener (as in the above case the softener and stearic acid) in benzene and measure the material volumetrically into a folded aluminum sheet dish. The benzene is allowed to evaporate before use. During mixing, the last trace of softener is removed from the dish by unfolding it and passing it through the mill several times.

Mixing is accomplished on a four-by-five-inch mill for batches containing up to 40 grams of polymer, on a four-by-nine-inch mill for batches from 40 to 100 grams and on a six-by-12-inch mill for batches from 200 to 500 grams.

The usual mixing procedure involves breaking down the rubber, or milling for ten minutes if little breakdown occurs (cold mill), followed by the addition of the zinc oxide and accelerator masterbatches. After blending, the softener is added and then the black. When no free black is visible, the batch is cut back and forth for thor-

ough blending. The sulfur masterbatch is then added, and the batch rolled up and passed endwise through the mill six times. It is then set aside for 24 hours and remilled for three minutes before samples are prepared for curing.

All polymers cannot be mixed by the same procedure since they do not all respond alike to mastication, to varying mill roll temperature, or to the incorporation of oils and pigments. An experienced mill man can be permitted to use his judgment as to the most satisfactory procedure to be followed with unusual polymers.

Curing and Testing

For the smaller batch sizes, undersized specimens for stress-strain are cured. These are sheets 1¼ by 2⅜ inches by 0.025-inch from which two micro-dumbbells can be cut. This dumbbell is not a standard ASTM shape, but gives results which are very close to those obtained using a standard die. The accompanying illustration shows one of these sheets and the micro-dumbbells, hysteresis pellets, and flex strip described in the following discussion. For larger batches standard ASTM sheets are cured, and standard dumbbell shapes used. The number of cures selected is usually five if the curing rate is to be established, but may be two if the properties to be measured are less critical with respect to cure. The curing temperature is usually in the range of 280 to 320° F. Any temperature may be chosen within this range, and the curing times adjusted to correspond. (Curing rate is doubled for an 18° F. increase in curing temperature.)

Stress-strain tests are run on Scott L-6 machines. For the micro-dumbbells a 60-pound capacity machine is used, and for the standard dumbbells a 150-pound capacity machine. For stress-strain at 100° C. a special Scott machine is used in which the sample is tested in air maintained at the required temperature. Although the entire stress-strain curve is obtained, usually only the modulus at 300% elongation and the ultimate tensile strength and elongation are reported.

For the hysteresis test which is run on the Goodrich flexometer, a pellet 0.7-inch in diameter by one inch high is molded, usually at two curing times. The test is run at 212° F. with a 55-pound load and a 17½% stroke. The temperature rise above 212° F. is reported after 25 minutes of operation. If the sample blows out before 25 minutes, the elapsed time and temperature at failure are given. The initial compression under the 55-pound load and the permanent set after the test is completed are also reported.

For the measurement of resistance to crack growth a one-inch wide strip is cured at the same time and temperature as used for the hysteresis pellets. The strip has a half round groove molded crosswise in the center of the strip. When a limited supply of the experimental polymer is available, this specimen is molded with the two ends made from a standard GR-S stock, and only 10-15 grams of the experimental stock are placed in the middle of the cavity. The crack growth test is run on a De Mattia-type machine having a speed of 300 cycles per minute and a stroke of one-inch. The test is run at 82° F. and at a constant 45% humidity. The samples are pierced before testing, and the rate of crack growth is recorded as the number of cycles required to reach various arbitrary ratings ranging from 0 (no cracking) to 10 (completely cracked). Usually the number of flextures required to reach the rating of 8 is recorded.

The amount of polymer required when mixed in a tread-type stock for the various tests is given in the table below:

Polymer Required for Various Tests

Test	Specimen & Wt./Specimen*		Total Wt. Req'd. G.*
Stress-strain in duplicate for five cures	2⅜"x1¼"x0.025	1.5 g.	15
Stress-strain at duplicate for two cures	2⅜"x1¼"x0.025	1.5 g.	3
Hysteresis for two cures	0.7" dia. x 1"	7.5 g.	15
Flexing (dummy ends) for two cures			15
Stress-strain in duplicate for three cures at R.T. and 100° C.	2⅜"x1¼"x.025	1.5 g.	9
Stress-strain using ASTM sheets at R.T. and 100° C. (per cure)	6"x6"x.075		55
Mooney viscosity original rubber and for each heat treatment period			35
Laboratory tubing test†			150
Extrusion plasticity‡			150

*Based on sp. gr. of 1.14.
†B. S. Garvey, Jr., H. M. Whitlock, J. A. Freese, *Ind. Eng. Chem.*, 34, 1309-12 (1942).
‡H. A. Schultz, R. C. Bryant, *J. Applied Phys.*, 5, 360-63 (1944).

For recipes having a higher or lower proportion of polymer to mixed compound, adjustments in the above figures should be made.

From these figures the tests which can be performed on a limited quantity of polymer may be readily ascertained.

Interpretation of Test Results

In the interpretation of test data on the vulcanizates it is necessary to keep in mind that: (a) the precision of the test methods is poor compared with those for many other tests with which the chemist is familiar (b) certain properties are closely related in GR-S stocks and that departures from these relations represent real differences between polymers; and (c) phenomena due to differences in state of cure are easily and frequently confused with differences in the polymers.

In addition to the relatively poor precision of many of the tests the problem is complicated by the possibility of errors in the weighing of the compounding ingredients, of differences in the mixing step, and of possible errors in time and temperature of cure. By the exercise of constant vigilance the errors in weighing and curing can be minimized. However differences in the mixing operation in spite of great care are likely to be appreciable. They are due to variation in the shearing action given the rubber due to differences in the roll settings and temperatures, and variation in the degree of dispersion of the carbon black and curing agents. For a particular compound more severe milling and better dispersion of the carbon black results in a decrease in modulus, an increase in elongation, an increase in hysteresis and an increase in resistance to crack growth.

Properties which are generally related include the following: high modulus with low elongation, low hysteresis, high rebound, poor resistance to crack growth, and poor resistance to hand tear; high tensile strength with high tear resistance; and high hot elongation with high elongation at room temperature.

We have found the relation between temperature rise as measured in the Goodrich flexometer and crack growth[4] to be a very useful indication of the quality of an experimental polymer with respect to this latter deficiency of GR-S. For a wide variety of compounds of GR-S regardless of type of accelerator, sulfur ratio, curing time, or softeners used, but containing either MPC or EPC blacks there is a definite relation between temperature rise and resistance to crack growth. With other blacks or mixtures of blacks or materials which cause lamination or pseudo-fibering this relation does not hold. A recognition of this relation permits comparisons to be made of vulcanizates of experimental polymers which are neither adjusted for optimum sulfur or accelerator ratios nor cured to the optimum cure.

There appears to be a general relation between ultimate tensile strength and machine tear (ASTM-D-624-41T) for GR-S (but not for natural rubber).

(*Continued on page* 524)

[4] A. E. Juve, forthcoming publication.

Recent Russian Literature on Natural and Synthetic Rubber—XXV

M. Hoseh

DETERMINATION of Hard Polymers in Divinyl Rubber. E. I. Gorina, *Kauchuk i Rezina*, 10, 16-17 (1940). **S-66.**

A new method for determining hard polymers in SK rubber consists of the following: 100 parts of SK are compounded with 0.8-part of Captax, one part of vulcan-orange, and two parts of sulfur. The compound is mixed for five minutes on cold mixing rolls; after which operation a sheet 1.5-2.5 mm. thick is obtained. Two pieces, 6 x 6 cm, are cut out from each sheet. Each sheet is placed between cellophane foil within a vulcanization mold. Vulcanization is carried out for 10 minutes, at 145° C.; then the pieces, without being removed from the cellophane, are inspected in light. The hard polymers appear as white, transparent spots. This method permits the detection of the smallest inclusions of hard polymers and requires only 20 minutes.

Separation of Fabric in Rubber Reclaiming. B. Ya. Osipovskii and A. V. Kozlovskaya, *Kauchuk i Rezina*, 10, 43-49 (1940). **SN-108.**

In this article 28 references, mostly to patents, on the separation of fabric in the reclamation of rubber are reviewed. Among the reviewed methods is one proposed by the authors, which consists of agitating finely comminuted rubber in a mixture of a rubber solvent and water. The solvent causes the rubber to swell, and the stirrer causes the fabric to separate from the swelled rubber. The wet fabric sinks to the bottom of the separator, from which it is drained off. Best results are obtained when the combined weight of water and solvent is 2-2.5 times that of the rubber. The most desirable size to which the rubber should be ground is so that it will pass through a 3-mm. mesh. This process operates most satisfactorily at room temperature.

Aqueous Emulsions of Rapid Drying Varnishes. N. S. Il'in and A. I. Strel'nikov, *Kauchuk i Rezina*, 10, (1940). **M-32.**

A new experimentally tested method for the preparation of varnishes for galoshes comprises concentrating the varnish base to a consistency of dry factice. The concentrate, which ordinarily does not dissolve in organic solvents, is brought into solution by autoclaving. The solution thus obtained is perfectly clear. Such solution prepared with (20% by weight of the base) a commonly used aliphatic solvent is then emulsified in water for further use. These emulsions have all the properties desired of quick drying varnishes.

Economizing on Zinc Oxide in Tread Rubber. P. I. Stepanov, *Kauchuk i Rezina*, 10, 57-58 (1940). **SN-109.**

The reasons for using ZnO in rubber mixes are not entirely clear, nor is the quantity to be used definitely established. A series of experiments is reported in which the effect of ZnO on the quality of tread rubber was studied. The quantities of ZnO used in the experimental mixes was 0-5 parts by weight of the rubber in the mix. The rubber used in these experiments was rod-polymerized SK. The properties tested were: Tensile strength, relative elongation, and set elongation. In tread rubber compounded of rod-polymerized SK, ZnO did not act as activator and did not improve the physical properties of the vulcanizate. Replacing ZnO by a corresponding quantity of lamp black did not lower the physical and mechanical properties of the product. ZnO may be entirely eliminated from tread rubber without impairing its quality. Such a step will save considerable quantities of Zn and at the same time lower the cost of rubber.

Carbon Black Compounds. G. L. Mayants, *Kauchuk i Rezina*, 10, 60-62 (1940). **M-33.**

The use of carbon black in compounding rubber on open mills presents many inconveniences. It is therefore suggested that the carbon black be supplied in the form of a rubber-carbon black preparation obtained by mixing the two in a closed mixer of the Banbury type. Details of this practice are discussed.

Thermal Polymerization of Divinyl over Activated Charcoal. P. V. Zhavoronkov, *Kauchuk i Rezina*, 11, 10-14 (1940). **S-67.**

Experiments were carried out on the polymerization of divinyl by passing it over activated carbon at 300-500° C. Experiments were carried out simultaneously on the thermal polymerization of divinyl without activated carbon by passing it merely through a heated, empty quartz tube. The divinyl used in these experiments, 96.8% pure, was passed from its container through a flow meter, then through two drying tubes filled with $CaCl_2$, into a quartz tube within an electric oven. The tube was 100 mm. long and 20 mm. in diameter. The liquid reaction product was collected in a receiver cooled to -5° C.; while the gaseous products were collected in an ampoule placed within a Dewar flask and cooled with dry ice.

Passing the divinyl through an empty tube at a rate of 75-80 ml. per minute at temperatures of 400-450° C. the condensate amounted to 40%. At the same rate of flow, but at temperatures below 400° C., the yield dropped to 10%. The boiling point and the index of refraction of the liquid product were identical with those of 1-ethenyl-3-cyclohexene and other divinyl polymers. An analysis of the gas leaving the tube showed a considerable drop in its divinyl content. The products of thermal condensation of divinyl are unsaturated compounds which on standing absorb avidly oxygen from the air and form peroxides. Freshly collected and distilled condensates gave no positive reaction with a fuchsin sulfite solution or with potassium iodide solution in a weakly acid medium.

When divinyl was passed through a tube charged with activated carbon and heated at 350-450° C., at first it was absorbed by the activated carbon and then liquid condensation products started to appear. Compared to the condensation products obtained in an empty tube, these products were more oily and besides 1-ethenyl-3-cyclohexene contained also the trimer and tetramer of divinyl. The yield of condensate increased as the temperature was raised from 350 to 450° C.

(*Continued on page* 524)

Advances in Rubber during 1946[1]

Ellwood F. Riesing[2]
and Joseph O. Callouette[2]

GOVERNMENT release of natural rubber for tire manufacturing was the single most important event to the industry during the past year. On the popular small sizes of passenger-car tires, only 1¼% of natural rubber was allowed in January, 1946. By November 1 this percentage was increased to 23%, and for small truck sizes the amount of natural rubber has since been boosted to 69%. For truck and bus tires, as well as for airplane tires, 100% natural rubber is now permitted by the government.

In addition to these partial reconversions to natural rubber in tires, a few statistical facts illustrating the tempo of this year's tire production should prove of interest. In 1940, just prior to the war, passenger-car tire production in the United States averaged 4,000,000 per month; for 1946, the monthly rate unfolds a 50% increase to almost 6,000,000 tires per month. For truck tires the 30-day output rate in 1940 was 725,000 units; this year it is averaging approximately 1,400,000 per month, representing an increase of approximately 100% (1)[3] Many refinements in tire building machinery and automatic and semi-automatic equipment have helped to accomplish this amazing production record (2, 3).

It is claimed that the tires being produced now, with the increased percentages of natural rubber and the improved synthetics, along with numerous other advancements, are superior to prewar natural rubber tires (4). The improvements, other than the modified elastomers contributing to the overall outstanding performance of current-day tires, result from such as the following:

(a) New and modifield forms of carbon black, so essential for reinforcing the GR-S compounds, give more efficient, cooler running carcasses, having greater resistance to tread cracking (5-9).

(b) New designs for tires bring easier rides, better stability, and greater safety (10-12).

(c) New tread patterns provide longer wear and better non-skid. New materials for tire cord give stronger casings with better blow-out resistance (13-16).

Improvement of the adhesion of the tire cord to the tire body is a constant development assignment in all tire plants. Much has been reported on this subject this year that is noteworthy in view of the difficulties previously encountered in obtaining adhesion to synthetic cord (17-21).

The tire cords which are the backbone of any tire are now being made of various and improved types of cotton, rayon, nylon, and steel (22).

Steel tire cords in the form of twisted small diameter steel wire cables for heavy-duty truck tires are reported to have several times the strength of textile fabric ply and provide considerably more resistance to bruises and blow-outs. These wire cables, in addition, open up a new field for heavy-duty V-belts and power transmission and conveyer belts (23, 24).

Butyl inner tube tests, conducted under desert temperature conditions and operating at high speed with overloads, 24 hours per day, five days per week, showed up to be vastly superior to natural rubber inner tubes in air-holding ability (25, 26).

No summary of advances reported in an industry is complete without reference to the year's "biggest," whatever it may be. One company claims to have built the biggest truck tire in its 48 years' history, an earth-moving tire casing, 27.00 x 33 size. It has a load rating of 31,050 pounds and in itself weighs 1,627 pounds (15). The biggest bomber tire in the world, built by another company, measured 110 inches in overall diameter and 44 inches across beads. This one tire and tube weighs 2,600 pounds (27).

Rubber as a resilient suspension medium for passenger cars, trucks, buses, airplanes, and Pullman trains has made the limelight this year. Much more should be heard on this subject within the next three to five years (28-31).

Much could be written for this past year on the development of plastics by the large tire and rubber companies and the integration of the rubber and plastic industries. Finished products fabricated from unadulterated plastics, and plastic and synthetic rubber compounds of various percentage combinations, have made their appearance on the market, introduced by several of the large rubber companies. These items range from garden hose to gasoline hose, wire coverings to floor coverings, packaging and materials to shoe soles. automobile to airplane parts, shower bath curtains to milady's plastic patent leather purses, shoes and belts, ice buckets to household, hotel, and theater upholstery materials, etc. (32, 33).

Phenolic plastic resins are reported to blend with synthetic rubbers to produce adhesives of outstanding quality (34, 35). It is disclosed also that phenolic resin-impregnated papers are being used in the rubber industry to take the place of reinforcing steel stampings in automotive mechanical rubber goods parts.

Research Development

"Research on synthetic rubber and latex already has reached the stage where new molecule building is almost a daily occurrence" (36).

Notwithstanding, additional research facilities have recently been completed by General Tire & Rubber Co. and by du Pont (37), augmenting Akron's buildings already devoted to this work (Firestone's and Goodyear's ultra-modern research units). In addition a new structure well under way by The B. F. Goodrich Co. is scheduled for completion next year. Besides these research centers a vast number of universities have entered into contracts with the Office of Rubber Reserve (RFC) covering research on synthetic rubber (38). Existing facilities and organizations to date are solely responsible for the high quality and versatility of present-day rubber, both natural and synthetic. However a tremendous amount of work still remains to be done to perfect, among other needs, better plasticizers, good high-temperature stabilizers, and other materials to extend rubber's usefulness (39).

Rubber research chemists and physicists continue their endeavor today more ardently than ever now that the gap is narrowing between their present-day knowledge of molecular theory of the elastomers and that of actually being able to see the rubber molecule. A new lens element or pole piece is under development to improve the electron microscope. This may make possible the visual isolation of the individual molecules of synthetic

[1] This article is based on a presentation made by Mr. Riesing before the Rubber & Plastics Division of the American Society of Mechanical Engineers, Dec. 2, 1946, Hotel Pennsylvania, New York, N. Y.
[2] Firestone Industrial Products Co., Detroit, Mich.
[3] Bibliography references appear at end of article.

and natural rubbers (40). In the interim of this period of actually separating the molecules, much is being learned of molecular behavior and structure (41).

We should note here that the electron microscope has enabled better evaluation of carbon black (42). Research work this year on black has aided the rubber industry in processing stocks and producing vulcanizates of more excellent properties (6, 7, 9, 43, 44). Since various blacks influence differently the modulus of compounds, a comprehensive investigation of the surface activity of a number of carbon blacks has been undertaken this year (45). Recent reports have referred to research development of a new white reinforcing material which functions in much the same manner as does present-day carbon black by embellishing the physical properties of the vulcanizate (46).

The infrared method of examination has associated variations in molecular chain structures of elastomers with the physical properties (47). Techniques with infrared spectroscopy result in faster and more accurate solutions of research problems involving molecular structures, particle sizes, polymerization, etc. (48). Particle sizes and molecular weights can also be determined now by a new means of light-scattering measurement (49, 50).

Investigators in some quarters this year have centered their efforts on the study of vulcanizates under tension. As a result, an apparatus has been invented to measure and correlate the tensile and electrostatic properties of rubber and GR-S at elevated temperatures (51). Tension studies have also advanced the theory of correct dependence of stress upon temperature (52). Tension samples at constant extension have unfolded a molecular theory to describe the permanent set taking place at elevated temperatures (53). Further, under extension, strain studies have been reported on the relation of stress-time and temperature (54). Also, data have been disclosed covering a new approach to the theory of tension-stress relation (55).

On molecular structures of rubber-like elastic bodies, a new theory has been expounded covering the molecular reaction under deforming forces (56). Large elastic deformations, as well as the effect of mechanical deformation on swelling capacity, have been explained in theory by several investigators (57, 58). Also, a new approach to the theory of long range rubber-like elasticity has been set forth associating it with an entropy effect dependent on the possibility of easy rotation about single bands in giant chains of network molecules (59).

Much has been reported this year on physical chemistry of high polymeric systems (60-87).

X-ray analysis has also continued to improve our knowledge of high polymeric elastomers. Investigations made on vulcanized and unvulcanized synthetic and natural rubbers stressed and relaxed at different temperatures have revealed much about the amorphous and crystalline structures and molecular orientation (88-91).

Research work on vulcanizing agents has unfolded an entirely new class of non-sulfur halogen compounds beneficial to GR-S (92).

Data of far-reaching interest was presented this year on the coefficient of friction of synthetic tire tread compounds on ice (93).

Research work on the original government GR-S and on new or modified synthetic rubbers has continued throughout the year. To date more than 360 experimental polymers have been approved by the Office of Rubber Reserve, and authority has been granted for trial production of a specified quantity of each for large-scale evaluation of processing and vulcanized properties.

Incidentally, although estimated demand for GR-S for the year was set at 679,000 long tons, it was not believed that production would exceed 615,000 tons owing to limited butadiene supply (94). Some interesting figures on the cost of alcohol-butadiene and petroleum-butadiene were published (95). Disposal of synthetic rubber plants to private manufacturers continued to occupy the attention of government officials (96).

Developments in Rubber

For the past century the development of a synthetic rubber of one sort or another has been worked upon by men of all means (97). The development of synthetic rubber in America extends over a period of almost 40 years (98). The most striking advances were crowded into the last decade and especially during the war years just past. This is evidenced by the amazing volume of literature being released today, now that government restrictions have been lifted from most subjects.

Of the 360 experimental polymers mentioned above approximately 80 have been put into worthwhile production this year. These polymers were developed for all kinds of end-products. Many of these experimental types were modifications of butadiene-styrene copolymers, resulting from the use of new emulsifiers and coagulants. But others have involved the replacement of either the butadiene with another diene such as isoprene or the replacement of the styrene with either substitute styrenes or other vinyl compounds. Descriptions of many of these appeared in the literature (99-102).

One of these modified GR-S copolymers provides extremely good building tack—a property so essential for tire building (103-105). The incorporation of pigments at a considerably increased rate during milling is also claimed for some of these new copolymers (106). Others have provided the wire and cable covering industry with an elastomer of exceeding low water absorption (107, 108).

In extensive production is a whole new set of high heat-resistant elastomers. Some of these withstand continuous temperatures of 300° F. and endure temperatures of more than 500° F. for eight to ten hours. They can also be used effectively at temperatures as low as —70° F. There will undoubtedly be many uses for these elastomers since they too can be tailor-made (109-113).

During the period of critical shortages of the war, the rubber industry investigated and tested various high molecular weight polymers belonging in the field of plastics. It was learned that many of these could be compounded or modified to give rubber-like elastomers. The materials performed so well in their new fields of application that the number of synthetic elastomers tripled (114). The latitude between the rubber and plastics industry is growing smaller, and competition keener, with each new development (115).

Processing and Testing Improvements

The work accomplished this year with electronic high-frequency preheating and vulcanizing has brought forth considerable data. Reports show substantial reduction in time required for vulcanizing and more uniformity of cure throughout the finished vulcanized product, rendering improved physical properties. Greater production per unit of molding equipment by this so-called heatronic method appeals to the industry, not only for the obvious reasons, but also for the effects on labor (116-118). The method makes possible the uniform vulcanization of rubber parts of extremely heavy sections, in a fraction of the time consumed by the conventional platen press or pot heater method.

Forward strides have been reported during the past 12 months in transfer and injection molding. Both ac-

complish the production of mechanical rubber goods parts of superior physical properties along with a reduction in curing time cycles. These molding methods also make possible a higher degree of accuracy for precision parts having rubber to metal adhesion inserts (119-121).

A contest held under the auspices of the Chicago Rubber Group on "The Utilization of Cured Synthetic Scrap" brought forth many interesting methods, some of which have been published this year. The Lancaster-Banbury method of devulcanizing mixed synthetic and rubber scrap is claimed to produce at reasonable cost a reclaim with properties comparable to those obtained by the more elaborate conventional methods of today (124). Since in the past few years we have produced little else but GR-S, it has been predicted that our supply of natural rubber scrap will diminish rapidly and that in two years a preponderance of reclaim will necessarily be GR-S. Therefore the urgency of solving this problem is apparent, as reclaim plays an important part in our national economy (123).

Many thoughts have turned to the reclaiming of scrap, mixed and sorted, and an economical procedure is reported for dealing with this scrap by using effective reclaiming oils or organic liquids (124, 125). It has also been disclosed that success has been achieved in the utilization of cured synthetics as scrap (126).

New innovations in continuous Buna S preparation and continuous coagulation of *Hevea* latex have been reported (127, 128). *Hevea* latex storage over long periods of time had not been investigated before the war. Data disclosed on preservation methods prove that natural rubber latex can be successfully stored for more than four years (129).

Data have also been published on the recommended GR-S and natural rubber ratios that result in abnormally high modulus values (130). For the first time since the end of the war a comprehensive set of wartime rubber production figures has been released (131).

An avalanche of new laboratory and factory production quality-testing methods appeared in this year's literature. Methods and measurements of hysteresis in rubber-like materials have been disclosed (132). A new laboratory test method is reported for measuring the low temperature stiffening of various elastomers (133) and also an improvement in apparatus for low temperature brittle point determination (134). Another laboratory technique employing temperatures from —50 to 200° C. has been perfected to demonstrate the effect of gaseous environment on dielectric strength and, more specifically, to evaluate the role of oxygen as a fundamental factor in dielectric failure on synthetic and natural rubbers (108). A separate evaluation method of the effective temperature and of oxygen concentration has been accomplished by comparing the results of both air-oven and bomb-aging at each of two temperatures, —80 and 100° C. (135).

It is a recognized and accepted fact that there is no correlation between durometer hardness and static compression modulus of vulcanization. A real need, therefore, existed for years, to enable rapid checking of modulus on production parts, such as automobile engine mountings. A factory device has been developed claiming to accomplish this (136).

A variety of new tests for diverse products made of natural and synthetic elastomers, developed by the U. S. Navy, has been published. Many of these tests are applicable to general-line items (137).

Laboratory methods of setting up accelerated weathering with ultra-violet radiation and dynamic flexing of elastomers are constantly being devised as the art of rubber processing advances (138, 139). The advantages of waxes in retarding weathering has been correlated on a new stretching-type test machine (140).

New technique, with a compression plastometer are possible, and information about the rheological properties that are commonly obtained with a compression plastometer can be supplemented if a few additional readings and calculations are made (141, 142). Details of a puncture-tear tester for rubber-like materials have also been made available (143).

Laboratory testing methods for a quantitative measuring of the state of cure can be performed by using a slight modification of the ASTM method "B"—Standard No. D-395-40T (144).

It has been concluded that the state of cure of neoprene vulcanizates can be determined by the rate of recovery of "racked" samples (145).

A microscopic technique has been disclosed which permits visual observation of structural changes of natural and synthetic rubbers during mastication and their subsequent recovery (146).

Of value to production departments is a new method made available for cleaning vulcanizing molds. Use is made of a soft grit obtained by grinding up corn cobs. This grit, when blasted under air pressure against the molding surfaces, does a thorough cleansing job without any injury to the molds (147).

Developments in Compounding Ingredients

The report this year of the discovery of an entirely new class of non-sulfur vulcanizing agents for the butadiene-styrene copolymers has been of tremendous interest to the rubber industry's compounding chemists. This new class consists of halogenated compounds which may be divided into three types: (1) halogenated aliphatic hyrocarbons containing at least one $—CX_3$ group, where X represents chlorine, bromine, or iodine; (2) halogenated aryl methyl compounds containing at least one halogen in the methyl group; and (3) aliphatic compounds containing a $—CX_3$ group and another reactive group, such as ethyl trichloroacetate. Each of these types behaves somewhat differently with respect to activation by metal oxides and other substances, but all will give vulcanizates having high moduli and good tensiles. The vulcanizing agents of the second type are of particular interest since by their use vulcanizates of unusual aging properties can be produced. These vulcanizates show no increase in moduli or decrease in elongations on 1-2-day 100° C. oven aging, and sometimes even show reversion on aging, which is a very unusual phenomenon for GR-S (92).

Other non-sulfur vulcanizing agents designed expressly for use with some of the newly modified GR-S copolymers are now available. In general all of these agents impart faster curing rates than does sulfur (148). However some actually enhance the physical properties of the finished product by lowering the hysteresis index and bettering the heat stability characteristics (103). Light-colored and white GR-S stocks show great increase in tensile when compounded with triethanolamine.

Much has been recorded over the past 12 months to improve the physical properties of stocks of natural and synthetic polymers through the use of new compounding ingredients and methods (149). The study of structural changes resulting from milling and subsequent recovery has been reported explaining variations in factory batches (146, 150-153).

Compounding variables that influence tensile strength in vulcanized rubber and the problem, "Why is one rubber stronger than another?" have been reported and the

factors which affect this property, such as polymer chain length relation and molecular weight, have also been revealed (154).

The use of certain activators with pure GR-S stocks is claimed to increase the tensile value and promote better aging resistance (155). GR-S stocks with improved characteristics for wire and cable extruded coverings are affected by compounding with various mineral pigments (87).

Carbon blacks, the mainstay reinforcement for synthetic and natural rubbers, have been improved and further studied this year to aid compounders in their problems of mixing stocks and bettering the vulcanized properties (9, 44). The important work on blacks can briefly be summarized as follows: the resultant effect of pelletization (7); the effect of variable quantities of black and softeners (6); the aiding of black dispersion (43); the influence of acetylene black on the electrical properties of GR-S (156).

In the past, rubber compounders have desired a reinforcing agent for light-colored and white stock that functioned as well as carbon black does for black stocks. Two announcements were made this year that should, therefore, prove to be of both interest and value. One is a light soot called "White Carbon Black," produced by the combustion of ethyl silicate (46). The other is a superfine silicon dioxide produced by the combination of silicon tetrachloride (157).

Noteworthy also to the compounders is the work reported on the following: the use of alkyl phenolic resins as tackifiers (158); the use of styrene-diene resins (159); plasticizing with various active chemicals (160); influence of polar compounds (Glycols) on hydrated calcium silicate and GR-S vulcanizates (161).

Some fundamental studies on the oxidation of GR-S, as well as other elastomers, is revealed and alkaline materials as accelerators for GR-S are compared in order to determine the effect of more strongly alkaline materials (162), finally promoting vulcanization of GR-S at room temperature (44, 163).

Also reported in the literature is the work done on the simultaneous incorporation of pigments and plasticizers in the form of premixed preparations (164). This incorporation is based upon the ratio of the materials used in such premixed preparations and is the deciding factor in their usefulness. For each filler there is a fixed ratio.

Considerable work has also been reported this year on compounding latex (165). Work has been done on black and non-black pigments in dispersions for compounding (166). Lignin is being used as a reinforcing agent with effective results when incorporated in latex by the masterbatching procedure. GR-S shows very outstanding properties for tensile strength and tear resistance when so compounded (167).

It is claimed that Buna N latex is finding use in reinforcing a variety of fibrous materials.

Summary

The conclusion for a year's summary paper such as this should not bear on the work reported during this past year, but should list next year's "needs" or "wants" of both the rubber manufacturers and the rubber users. Paramount under the heading of "wants" is a definite national policy from the government on synthetic and natural rubber. Under "needs" the classic problem of the chemical reaction of vulcanization remains to be solved in order to open up new avenues in compounding approach. Next in importance in the authors' opinion is the "need" of a method of reducing to a minimum the Joule effect on vulcanized elastomers, or a means of compensating for it mechanically in various products. Also "needed" is a synthetic rubber having extremely high efficiency along with a degree of oil resistance surpassing that of any of the present-day so-called oil resisting elastomers that either swell or shrink excessively and are high in hysteresis index. Further required by the rubber manufacturers is a class of vulcanizing agents that will produce optimum cure to stocks of natural and synthetic rubber blends.

It is the author's prediction that some of these "needs" and "wants" will become a reality before the end of 1947.

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(162) "Alkaline Materials as Accelerators for GR-S." J. Breckley, India RUBBER WORLD, 114, 663 (1946).
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Methods for Evaluating

(*Continued from page* 517)

The tensile strength and elongation at 100° C. for GR-S stocks, when expressed as a percentage of their room temperature values, are fairly constant regardless of state of cure or compounding modifications. These percentages should be examined, and not the absolute values. While in general high hot elongation in GR-S correlates well with good resistance to crack growth and with good carcass performance, it can only be attained by lowering the state of cure. What is desired is a rubber which will retain a much higher proportion of its room temperature elongation so that resorting to low states of cure will be unnecessary. More emphasis is placed on hot elongation than on hot tensile strength because it is believed to be the more significant property. A stock having 400 p.s.i. tensile strength and 600% elongation at 100° C. is preferable to one having 1,200 p.s.i. tensile strength with 200% elongation.

Test differences between two compounds may frequently be ascribed to differences in the polymers when they are due to differences in state of cure. For example, an experimental polymer which exhibits high modulus and low elongation with normal tensile strength may be badly overcured rather than inherently a high modulus rubber. If the curing time was selected arbitrarily and the polymer for one reason or another activated the cure, an adjustment should be made in the curing time and/or accelerator. If, after this adjustment is made, high moduli are still obtained, a polymer difference is indicated, and adjustments in the sulfur ratio should be made.

Different laboratories use different procedures and test methods in the evaluation of new polymers and may place a different emphasis on the importance of certain of the properties. Consequently a number of laboratories evaluating the same polymer may not agree in their conclusions as to its merit. This may be the case particularly, when the new polymer differs but slightly from GR-S. However, when an appreciable improvement has been made, all laboratories are likely to agree.

Recent Russian Literature

(*Continued from page* 518)

and the rate of flow was 100 ml. per minute. These experiments showed conclusively that activated carbon promotes the stability of divinyl when passed through it at a temperature of 500° C.

Technology of the Die Casting of Rubber. B. I. Frimerman and L. G. Margulis, *Kauchuk i Rezina*, 11, 19-23 (1940). **SN-111.**

The die casting process of rubber is reviewed. Schematic flow sheets of assembling by hand and die casting of all-rubber products are compared. The two methods of extruding the rubber into the mold, in one of which the rubber flows in the same direction as the plunger, and in the other it flows in the direction opposite to the plunger, i.e., through a vent in the plunger itself, are compared, and their merits and demerits discussed.

Sunflower as Rubber Bearing Plant. N. F. Vorob'eva, *Kauchuk i Rezina* 11, 23-25 (1940). **N-29.**

At the Saratov Experiment Station the rubber content of decorative and oil-bearing varieties of sunflowers was determined. In the leaves of oil-bearing plants the rubber content varied from 1.4 to 5.75%, and the resin content was 4.3-7.7%. In the decorative varieties the rubber content was 0.9-3.21%, and the resin content 10.1-14.5%. Assuming 50,000 plants per hectare (2.5 acres) certain varieties of sunflower would yield 127.7-189.5 kg. (280-415 lbs.) of rubber.

(*To be continued*)

EDITORIALS

Let's Have No More International Rubber Regulations!

JUST before the meeting of the International Rubber Study Group at The Hague on November 25, Pieter Honig, deputy director of the Netherlands Indies Government Deparment of Economic Affairs, was reported as advocating the establishment of a new international rubber control plan which would permit working out an arrangement between producers of natural, and synthetic rubber as the "only solution of the problem of potential overproduction." At about the same time the *London Times* in an article entitled, "Rubber in a Free Market," concluded that since some time in the near future there will be too much rubber, either there will be a fight with estate against smallholder, and both against synthetic production — which in the United States will have, at any rate, the partial support of the government—or there will be a new international agreement.

The *London Times* article goes on to point out that some believe that such a fight would result in the extinction of all but the most efficient estates and that the future does, in fact, lie with the smallholder and the synthetic plants. To this realistic observation is added the comment that the small holder, for example, has appeared in the past to be satisfied with a lower price than the estate, and judging from the way native rubber has been produced in the East during the past year, that is true today. Further confirmation of the potential production capacity and the low cost of rubber from smallholders' estates is found in the article by P. T. Bauer, an economist of the Manchester School, which is reprinted from the *Royal Economic Journal* elsewhere in this issue. This article by Bauer has as its major purpose the discrediting of international rubber regulation, and with this effort we are in hearty accord.

In spite of this and other evidence unfavorable to the resumption of rubber regulation, the *London Times* article insists that the most likely outcome of the whole rubber position is some new regulation scheme.

"It may not come next year or the year after, but there is little doubt that some scheme will be necessary ultimately. There is little doubt, either, that when the need arises, another international rubber agreement will be reached unless there is a complete change in the attitude of the United States. The latter is not, however, impossible," the *London Times* concludes.

It is with the above paragraph of the *Times* article that we are at first concerned. If, as it is inferred, sentiment in some parts of government and industry in the United States is or will be in favor of a new rubber regulation scheme, it is contrary to the published statements of leaders in these fields. The existence of such sentiment we are inclined to doubt, but to insure its complete elimination our Inter-Agency Policy Committee and Congress should take a strong position against international agreements and in favor of free competition.

The *Times* article also states that a future battle among the estates, the smallholder, and synthetic rubber would result in the elimination of all but the most efficient estates and that without an international agreement the United States would support the synthetic industry. The indication seems to be that such a procedure would not be entirely fair since it would be the competition of the U. S. Government supported synthetic rubber industry against the private interests concerned with natural rubber production. Whether the U. S. synthetic industry remains partially or wholly government controlled, high-cost synthetic plants have already been eliminated, and it is not likely that we would favor any arrangement that would support high-cost natural rubber production.

The Bauer article shows that the price of estate rubber was artificially supported prewar and that both the production and the price of rubber from smallholders was very greatly interfered with. Any future regulation scheme will require the support of the United States, and if this support is not given, one outcome might be an attempt to limit the amount of natural rubber available to this country. In view of the fact that we have demonstrated our ability to get along on about 100,000 tons of natural rubber a year, this type of restriction would have little chance of success. Not to be overlooked is the fact that the production and use of a minimum of 250,000 and a maximum of 500,000 tons of synthetic rubber in the United States for some time to come is a foregone conclusion and will have a direct bearing on the future world rubber picture.

It is also quite probable that with the changed political status of the Netherlands East Indies and to a certain extent Malaya, the support of high-cost production of natural rubber in these areas by the owners of large estates would be extremely difficult, if at all possible.

From the "straws in the wind" department comes the information that in Ceylon following the resumption of private trading the price of rubber broke sharply to about 18¢ a pound. The British Government had been offering 21.5¢ a pound for Ceylon rubber in November and December, and following this break the government established a floor price of 19.7¢ a pound for this rubber. This happening coupled with the small amount of buying on the London market at the present asking price of about 23¢ a pound would seem to indicate that without regulation and restriction the price of natural rubber will fall to the point where the potential future record production would find a ready market, and consumers of rubber goods the world over would derive much benefit.

The new Congress has the responsibility of enacting permanent legislation to insure national security in rubber and a minimum synthetic rubber industry in the United States. Let us be sure this legislation prohibits participation in international regulation agreements.

Scientific and Technical Activities

Division of High-Polymer Physics, A.P.S., New York Meeting

THE Division of High-Polymer Physics of the American Physical Society will hold a meeting in New York, N. Y., at Columbia University on January 30, 31, and February 1 in connection with the annual meeting of the parent society held during the week beginning January 27. H. A. Robinson, Armstrong Cork Co., chairman of the Division, will be in charge of the meeting, with separate session chairmen as indicated in the program below. The papers to be given are broadly representative of the field of high-polymer physics, with emphasis on fundamental aspects. R. B. Stambaugh, Goodyear Tire & Rubber Co., Akron, O., is chairman of the program committee.

PROGRAM OF DIVISION OF HIGH POLYMER PHYSICS

January 30, at 10:00 a.m.
S. L. Gerhard, Presiding

Address of Retiring Chairman. Mr. Robinson.

The Determination of Macromolecular Configurations in Dilute Solution by Light Scattering. P. M. Doty, W. A. Affens, and B. H. Zimm, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

The Relation between Intrinsic Viscosity and Molecular Weight in Polymer Solutions. P. Debye, Cornell University, Ithaca, N. Y.

Time-Dependent Strain Birefringence in Viscoelastic Materials. Turner Alfrey, Jr., Polytechnic Institute of Brooklyn.

January 30, at 2:15 p.m.
A. W. Kenney, Presiding

Velocity and Attenuation of Sound in Rubber. W. B. Thompson, B. A. Mrowca, and Eugene Guth, University of Notre Dame, South Bend, Ind.

Elastic Losses of Natural and Synthetic Rubber as a Function of Frequency and Temperature. H. S. Sack, and H. L. Raub, Cornell University.

The Torsion of a Rubber Cylinder. R. S. Rivlin, British Rubber Producers' Research Association, London, England.

Heat Conductivity of Natural and Synthetic Rubbers under Stretch and at Low Temperatures. H. D. Smith, T. McC. Dauphinee, and D. G. Ivey, University of British Columbia, Canada.

Relaxation of Stress in Plastic Materials. M. Mochulsky, R. D. Andrews, and A. V. Tobolsky, Princeton University, Princeton, N. J.

January 31, at 9:00 a.m.
R. B. Stambaugh, Presiding.

Some Dielectric Properties of Butadiene-Containing Polymers and Copolymers. R. F. Boyer, E. B. Baker, and P. C. Woodland, Dow Chemical Co., Midland, Mich.

Dielectric Properties of Rubber, Particularly of Loaded Stock. L. V. Holroyd, B. A. Mrowca, and Eugene Guth, University of Notre Dame.

Frequency Response Characteristics of Dielectric Materials and Their Interpretation. A. von Hippel, H. B. Callen, and W. B. Westphal, Massachusetts Institute of Technology, Cambridge, Mass.

The Electrical Resistivity of Conducting Rubber. Paul E. Wach, University of Notre Dame.

Measurements of the Refractive Index of Films. Fred W. Billmeyer, Jr., E. I. duPont de Nemours & Co., Inc., Wilmington, Del.

Business Session of the Division at 11:45 a.m. H. A. Robinson, presiding.

February 1, at 10:30 a.m.
H. A. Robinson, Presiding

Six Rules for Analyzing Stress-Strain Curves. George Halsey, Textile Research Institute, Princeton, N. J.

Studies of Cellulose Acetate with the Ultracentrifuge. S. Singer and H. Mark, Polytechnic Institute of Brooklyn.

An Instrument for Measuring Particle Diameters and Constructing Histograms from Electron Micrographs. E. E. Hanson and J. H. Daniel, Firestone Tire & Rubber Co., Akron.

Abstracts of Papers

Abstracts of the above papers as furnished by the Division are given below:

The Determination of Macromolecular Configurations in Dilute Solution by Light Scattering. The interference pattern produced by monochromatic light scattered from solutions of fractionated polystyrene has been studied. In particular, the dissemmetry coefficient of Debye, the fractional difference of the intensities of the light scattered at two different angles, has been investigated as a function of concentration, of solvent, and of molecular weight of the polymer. The variation with concentration is large and is characteristic of the particular solution, but it was found possible to extrapolate to infinite dilution to obtain a coefficient characteristic of the polymer alone.

From this limiting or "intrinsic" coefficient, the root-mean-square distance, R, between the ends of the chain molecule may be calculated by exact equations. It was found that R varied as the square root of the molecular weight, as predicted by the theories of chain statistics, but that it was only slightly dependent on the nature of the solvent. On the other hand, the intrinsic viscosity of the same materials was markedly dependent on the nature of the solvent.

Some typical data are shown below:

Polystyrene Molecular Weight	Solvent	R	Mol. Wgt./R^3	Intrinsic Viscosity
4,800,000	Toluene	2370Å	...	7.6
4,800,000	Butanone	2100Å	1.10	2.3
11,800,000	Butanone	2770Å	1.53	4.1
2,100,000	Butanone	1230Å	1.38	1.45

The Relation between Instrinsic Viscosity and Molecular Weight in Polymer Solutions. If a polymer molecule of the coiling type suspended in a liquid is exposed to forces due to a flow-pattern of the liquid as used in viscosity measurements, its center of gravity will move with the liquid, and at the same time the molecule as a whole will rotate with an angular velocity determined by the velocity gradient. Notwithstanding this adaptation of the motion of the molecule to that of the liquid, a relative flow of the liquid with respect to the molecule remains. With the assumption that the average density in space of the polymer molecule is so small that its disturbing effect on the motion of the liquid can be neglected, it can be shown that the intrinsic viscosity of a solution will be proportional to the average distance of the average monomer group of the chain from the center of gravity of the whole molecule. This means that in this approximation Staudinger's rule should hold, which makes the intrinsic viscosity proportional to the molecular weight.

However, neglecting the disturbing effect of the molecule on the regular flow pattern of the liquid is too poor an approximation. A mathematical method has been developed which makes it possible to take care of this disturbance. The final conclusion is that the intrinsic viscosity depends on two fundamental constants, each of the dimension of a length, which characterize the molecule.

The first of these constants is the familiar average distance, D, between the two ends of the chain or the corresponding spherical volume proportional to the third power of D, which can be taken to represent a measure for the average volume occupied by the polymer molecule in the solution.

The second constant is a length, L, determined by the average density with which the molecule fills its allotted space. It is a measure for the distance over which the outside velocity distribution makes itself felt into the interior of this space.

The intrinsic viscosity is represented by a product of which the first factor is the specific volume of the molecule defined as the volume occupied by the mass of the polymer molecule. The second factor is a relatively simple function of the quotient D/L, a quantity which I would like to call the "shielding ratio." It turns out that for a linear polymer the intrinsic viscosity is proportional to the molecular weight (Staudinger's Rule) for small values of the shielding ratio; whereas for large values of this ratio it becomes proportional to the square root of the molecular weight. In an intermediate case the curve can be approximated over a large range of molecular weights by the customary power function. The exponent has some value intermediate between 1 and ½ and is determined by the shielding ratio.

Discussed in this way, measurements on intrinsic viscosity give information about the actual size of the polymer molecule in solution and its change with the solvent. As already indicated by measurements on the dissymmetry of light scattering, it is found again that D is a good deal larger than would be expected from Eyring's theoretical formula (no interaction, free rotation). The way is also opened to the use of viscosity measurements in order to obtain information about branching, since branching will affect the space-density of the polymer molecule, which determines the shielding ratio.

Time-Dependent Strain Birefringence in Viscoelastic Materials. The phenomenological theory of strain birefringence in viscoelastic materials is developed. The material is assumed to be homogeneous, amorphus, and (in the unstrained state) isotropic. The purely mechanical behavior

is assumed to be representable in terms of a distribution of mechanical relaxation times—i.e., the material obeys the Boltzmann superposition principle. Each molecular mechanism of mechanical response to stress will have associated with it a certain strain-optical constant. This results in a definite pattern of (time-dependent) birefringence when stresses are applied. The theory has two possible applications: the use of photoelastic creep studies in the investigation of *molecular mechanism* of viscoelastic behavior, and the analysis of the optical creep effects which may occur when imperfectly elastic materials are used in photoelastic studies of stress distributions.

Velocity and Attenuation of Sound in Rubber. Velocity and attenuation of sound in rubber strips were investigated by the standing wave method suggested by Bridgman and Brueblood, developed to measure the dynamic modulus of Silverman and Ballou, and extended by us and Nolle and Bolt (M. I. T.) to measure attenuation also. Amplitude of vibration in this method is below 0.001%. Velocity and attenuation of sound both decrease with temperature and with frequency in the range 500-600 cycles per second for *Hevea* and synthetic gum stocks. From the velocity and attenuation of sound, the dynamic modulus and internal friction constants were derived, assuming a proportionality of the viscous forces to the rate of deformation. Both the dynamic modulus and internal friction decrease with increasing temperature. The former fact is in contrast to the increase of the static and dynamic modulus at large amplitudes predicted by the statistical theory of rubber elasticity and confirmed by experiment. Probably for such small amplitudes the intermolecular theories chiefly determine the temperature dependence of the dynamic modulus for rubber just as for all other materials. Although the measurements at Notre Dame were checked by those at M. I. T., both groups feel that more accurate data are needed before final conclusions can be reached, particularly with regard to the temperature dependence of dynamic modulus. Financial support of Office of Naval Research, Navy Department, is gratefully acknowledged.

Elastic Losses of Natural and Synthetic Rubber as a Function of Frequency and Temperature. The elastic losses of unloaded samples of natural rubber and synthetic rubber of the GR-S type containing different amounts of styrene were measured. The sample, in the form of a reed, is acted upon by an alternating force of constant amplitude and adjustable frequency. The motion of the end of the reed is observed by means of an optical method. Signals proportional to and in phase with the force and elongation respectively are obtained and applied to the two pairs of deflecting plates of an oscilloscope. Thus a picture of the elastic hysteresis loop is obtained. The area of this loop is a measure for the elastic losses in the sample.

Observations were made in a frequency range from 300 to 4,000 cycles per second and at temperatures from —60 to +35° C. The results can be qualitatively interpreted by a relaxation theory; the relaxation time varies very strongly with temperature and with the styrene of the synthetic rubber. The crystallization of the samples is accompanied by a strong increase in the losses when the temperature decreases, and then a further decrease is experienced at still lower temperatures.

This paper is partially based on work sponsored by the Office of Naval Research, Navy Department.

The Torsion of a Rubber Cylinder. In a series of papers pending publication[1] a mathematical formalism has been developed for the solution of problems concerning the deformation of highly elastic materials.

The present paper is concerned with the experimental verification of the predictions of one paper of this series, in which the torsion of a rubber cylinder is discussed on the basis of this theory and it is found that, in order to produce pure torsion in a rubber cylinder, a compressive longitudinal thrust must be applied over the plane ends of the cylinder, in addition to the torsional couple.

The distribution of this thrust over the ends of the cylinder and its dependence on torsion are investigated experimentally in the present paper, and agreement with the theoretical conclusions is obtained.

Heat Conductivity of Natural and Synthetic Rubbers under Stretch and at Low Temperatures. Heat conductivity of natural and synthetic rubbers was studied in the range from +50 to —160° C. and from 0 to 100% stretch for two different cures and ages. The apparatus was a greatly modified version of one designed by Schallamach. Both for natural and synthetic rubbers, the value of the heat conductivity measured perpendicularly to the direction of stretch was smaller and the rate of change of conductivity larger in the stretched than in the unstretched state. On the lowering of the temperature and the raising of it again, natural rubber shows very complicated hysteresis phenomena due to progressing or regressing crystallization. Synthetic rubber shows a simpler behavior, exhibiting a hysteresis loop due to the transition of second order from elastic to brittle, glassy material. The hysteresis phenomena for both types of rubber show great similarity (in particular in thermal conductivity near the brittle point) to the drop in specific heat observed by Bekkedahl and associates. The effect of cure and the effect of aging depend on the position of the temperature with regard to the transition temperature. Above and below the transition region, the heat conductivity decreases approximately linearly with the temperature as one may expect from theory. Theoretical approaches to heat conductivity of polymers will be discussed briefly.

Financial support by the National Research Council of Canada is gratefully acknowledged.

Relaxation of Stress in Plastic Materials. Studies of relaxation of stress at constant extension over a wide range of temperatures were extended from rubbery to plastic materials. These studies were interpreted in terms of such variables as molecular weight, cross-linkage, chain stiffness, crystallinity, and interchain interaction. The effect of plasticizer was also investigated. Decay of stress due to chemical scission was observed in at least one linear thermoplastic.

Some Dielectric Properties of Butadiene-Containing Polymers and Copolymers. A study of the dielectric properties of mixtures of polystyrene and polybutadiene revealed a peak in the power factory-frequency curve at 100 megacycles. This peak was first ascribed to vinyl side groups, but it was then found that purified, natural rubber also showed a peak of about the same magnitude and at the same frequency.

Consideration was next given to the idea that a long chain of conjugated double bonds is a perfect electrical conductor.[2] It was thought that a regular distribution of double bonds, as along a chain of polyisoprene, might cause dielectric dispersion when the transit time of electrons along the polymer chain was equal to the frequency of the applied field.

Dispersions of carbon black in polyethylene were made to simulate roughly the proposed mechanism of dielectric loss. Such systems showed both a low frequency as well as a high frequency power peak. Both peaks depended in magnitude on the orientation of the carbon black particles with respect to the electric field, being smaller when the axis of the particle was perpendicular to the field.

Dielectric Properties of Rubber, Particularly of Loaded Stock. Dielectric constants and losses were measured in the range from 0-200 megacycles. In general, dielectric constants decrease with increasing frequency, with a drop corresponding to the peak in the loss-frequency curve. The peaks observed in the loss-frequency curve at low frequencies may be interpreted as due to oxidation and to fillers and at high frequencies as due to dipoles caused by the bonding of sulfur in vulcanization. Changes of dielectric constants and of losses, in particular, shifts in peaks with temperature in the range of 0-70° C., were also studied. Dielectric constants of rubber-carbon black mixtures from 0 to 25% volume concentration were observed and compared with theory of spherical particles indicated by Guth.[3] An extension of this theory to ellipsoids was also used in the interpretation of the data. Infinite conductivity of carbon black as compared to that of rubber was assumed. Results may be interpreted by assuming that carbon black particles preferentially form doublets. This result on doublets is also indicated in data kindly communicated to us by Dr. Breckenridge in von Hippel's laboratory (M. I. T.). Financial support by ONR, Navy Department, is gratefully acknowledged.

Frequency Response Characteristics of Dielectric Materials and Their Interpretation. This paper presents dielectric constant and loss characteristics of gases, liquids, and solids measured over a broad frequency range and considers their interpretation in terms of molecular physics.

The Electrical Resistivity of Conducting Rubber. The electrical resistivity of GR-S loaded with Shawinigan and Continental R-40 carbon black was determined as a function of temperature, elongation, time, and percentage volume loading. The resistivity of GR-S-Shawinigan mixes first increases with elongation, and then decreases; the peak occurs between 10 and 20%, but the resistivity of GR-S-R-40 mixes increases for all elongations. The resistivity of all stretched samples decreased exponentially with time. These resistivity-temperature curves exhibited hysteresis loops for samples stretched to high elongations or highly loaded. A plot of log-conductivity *versus* 1/T yielded straight lines. The temperature coefficient of resistivity for unstretched samples loaded with Shawinigan black is positive for all loadings investigated and increases with loading. Both Shawinigan and R-40 blacks have a negative temperature coefficient of resistivity. Both positive and

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[1] Rivlin, *Phil. Trans. Roy. Soc. A.*

[2] "Surface Chemistry." F. London, American Association for the Advancement of Science, Washington, D. C. (1943). P. 144.

[3] *J. Applied Phys.*, (1944).

negative temperature coefficients were observed for unstretched samples loaded with R-40; the coefficient is negative for low loadings and positive for higher loadings. Log-resistivity *versus* carbon concentration yielded exponentially decreasing curve, and log-resistivity *versus* log-concentration an approximately linear relation. Interpretation of data will be discussed.

Financial support of ONR Navy Department, is gratefully acknowledged.

Measurements of the Refractive Index of Films. The refractive index of film of transparent or translucent material may be determined by immersing the film into a suitable liquid mixture and observing the intensity of light reflected from the surface of the specimen. The composition of the immersion liquid is varied, and a record is made of its refractive index (measured on a refractometer) and of the reflected light intensity. The refractive index of the film is the same as that of the immersion liquid giving the lowest reflected intensity. This point has been confirmed by experiments with a glass plate, whose refractive index was known. According to Fresnel's laws of reflection, the experimental data should fit a parabola with its minimum at the refractive index of the film. On fitting the data by the method of least squares, the minimum is obtained with a standard deviation of the order of 0.002 refractive index units. The method has been applied to several plastic materials.

Six Rules for Analyzing Stress-Strain Curves. In the analysis of the stress-strain properties of a material there is a certain advantage to the making of haphazard stress-strain curves following no particular pattern. As more painstaking analyses are attempted and as the model is refined, this procedure becomes very wasteful. The writer has attempted to improve the situation by setting up a series of six rules for the analyses of stress-strain curves.

In the present paper the general distribution of non-Newtonian relaxation times is included in the scheme of analysis. Also, the existence of multiple equilibrium positions at the same value of the flow coordinate is discussed. The paper is organized into six rules of procedure, each containing a simplifying criterion. If all six criteria are obeyed, then the material under study is representable by a hyperbolic sine-law model. The six rules suggest an orderly mode of experiment.

Studies of Cellulose Acetate with the Ultracentrifuge. Measurements on a series of fractions of cellulose acetate in acetone have been performed with the velocity ultracentrifuge combined with free diffusion experiments. The molecular weights, M, of these fractions varied from 10,000 to 200,000, and in this range the sedimentation constant, *s*, varied considerably with M. In a system where *s* is independent of M, the particles may be considered "free-draining," that is, solvent freely penetrates the molecule. For particles impermeable to solvent and randomly coiled, *s*, is proportional to $M^{\frac{2}{3}}$. Our results indicate that the cellulose acetates are intermediate between these two cases.

Moreover on the assumption that the molecules may be satisfactorily represented by ellipsoids of revolution, axis ratios are calculated from sedimentation data and viscosity data independently, by Perrin's and Simha's equations, respectively. The axis ratios so calculated differ by factors outside of experimental error and indicate that the model is not a quantitative one for cellulose acetate in acetone.

An Instrument for Measuring Particle Diameters and Constructing Histograms from Electron Micrographs. An instrument for shortening the time and labor required in constructing particle-size histograms from electron micrographs is described. Representative histograms obtained with the instrument for GR-S latices are shown. Linear, surface, and volume-equivalent diameters of non-spherical particles are defined, and variations in the instrument for plotting such diameters are proposed.

High Polymers Aging Symposium

PREVENTIVE measures now being developed to cut down the many millions of dollars of loss occurring annually from the deterioration of synthetic fibers, plastics, and rubbers were outlined by leading research chemists in a symposium on the "Degradation and Aging of High Polymers," held November 30 at the Polytechnic Institute of Brooklyn, under the auspices of its Institute of Polymer Research.

Scientists at the meeting reported the research being carried on to utilize antioxidants, such as phenyl-beta-naphthylamine, to halt oxidation of plastics when exposed to light or to air at high temperatures. Also being investigated are the use of inhibiters during manufacture, such as hydroquinone and tert-butyl catechol. Both antioxidants and inhibiters are being tested in industry, said Herman Mark, director of the Institute of Polymer Research, who predicted that more durable synthetic products that will be heatproof, shatterproof, and crackproof will soon be produced as a result of the concentrated research on aging.

Speakers at the symposium included R. B. Mesrobian, of Princeton University, who discussed "structural and Chemical Aspects of Vinyl and Diene Polymers"; C. C. Price, of Notre Dame University, who spoke on "Mechanism of Inhibition"; R. F. Boyer, of Dow Chemical Co., who gave a paper on "Degradation and Light Aging of Polystyrene and of Polyvinylidene Chloride"; G. H. Smith, of Firestone Tire & Rubber Co., who discussed the "Antioxidant Effect in Natural and Synthetic Rubbers"; and A. M. Neal, of the rubber section of E. I. du Pont de Nemours & Co., Inc., whose topic was the "Role of Oxygen in the Degradation of Elastomers."

The next symposium of the Institute was scheduled for December 28, to cover "Copolymerization," with C. C. Price, of Notre Dame University, chairman of the session.

Rubber Division Spring Meeting

THE Division of Rubber Chemistry, American Chemical Society, plans to hold its spring meeting in Cleveland, O., on May 26 to 28. Headquarters of the Division will be at the Hotel Cleveland. The customary banquet will be held Tuesday evening, May 27, with the hotel to be announced later. General chairman of the meeting is A. I. Brandt, of B. F. Goodrich Chemical Co. A request for papers to be presented by members at this meeting will be sent out by the secretary to the membership list early in January.

National Power Show

THE Seventeenth National Exposition of Power and Mechanical Engineering was held December 2 to 7 at Grand Central Palace, New York, N. Y., in conjunction with the annual meeting of the American Society of Mechanical Engineers, December 2 to 6, at the Hotel Pennsylvania. An estimated 55,000 visitors viewed the almost 400 exhibits which occupied four floors of the Palace, in what was the largest show to date in the series.

Exhibit classifications covered the entire field of power generation, conversion, distribution, and application to productive machines and equipment. Classifications covered included heat and power production, such as boilers, conveyers, feed pumps, burners, blowers, heat exchangers, etc.; means of distribution such as piping, valves, steam traps, pressure regulators, etc.; auxiliaries, such as proportionate feeding systems, automatic alarms, safety appliances, air filtering equipment, level controls, etc., and their instruments; machinery, such as speed transmissions, pulleys, belts, chain drives, couplings, bearings, gears etc.; materials handling, such as hoists, conveyers, lift trucks, etc.; engineering materials; and machines and tools for plant maintenance and field work.

Among the exhibitors was the Cambridge Instrument Co., Inc., New York, with a display of controlling and recording instruments. The industrial insulation division of Eagle-Picher Co., Cincinnati, O., displayed its line of insulating cements, flat materials, pipe coverings, fill materials, protective coatings, and anti-condensation compounds. The industrial products division of The B. F. Goodrich Co., Akron, O., exhibited Climax flexible couplings, Multi-V belts, and Variable V planetary speed selector. Complete lines of industrial oils and greases were exhibited by Shell Oil Co. and Socony-Vacuum Oil Co., both of New York. Taylor Instrument Cos., Rochester, N. Y., showed its instrument controls and recorders; while Yarnall-Waring Co., Philadelphia, Pa., displayed steam plant equipment, including expansion joints, boiler blow-off valves, water columns and gages, steam traps and strainers, spray nozzles, and liquid level indicators.

Other exhibits of interest included the series of inverted bucket steam traps shown by the Armstrong Machine Works, Three Rivers, Mich. Much attention was drawn by the several exhibits of "packaged" steam generators, such as the type displayed by Cleaver-Brooks Co., Milwaukee, Wis. An all-metal variable speed transmission featured the exhibit of Graham Transmissions, Inc., Milwaukee; Reeves Pulley Co., New York, displayed variable speed control. Steam, air and water equipment of many types was exhibited by the Johnson Corp., Three Rivers, Mich. Heating equipment was well represented at the show with exhibits of unit heaters by Modine Mfg. Co., Racine, Wis.; Aero heat exchangers, evaporative condensers, and spray coolers by Niagara Blower Co., New York; and Sarcotherm hot water heating controls by Sarcotherm Controls, Inc., New York, among others. Many types of air cleaners and filters were displayed, including the Fiberglas Dust-Stop air filters of Owens-Corning Fiberglas Corp., Toledo, O. The chemical feeding and proportioning pumps displayed by % Proportioneers, Inc. %, Providence, R. I., also received much attention.

Rubber and Plastics Division, A. S. M. E., December Meeting

As a part of the annual meeting of the American Society of Mechanical Engineers, the Rubber and Plastics Division held two technical sessions on December 2 at the Hotel Pennsylvania, New York, N. Y. James H. Booth, Thompson Products, Detroit, Mich., chairman of the Division, opened the first session on rubber and then turned this session over to Sidney M. Caldwell, United States Rubber Co., New York, who acted as chairman. The recorder for the rubber session was E. A. Roberts, Firestone Tire & Rubber Co., Detroit. The chairman for the evening session on plastics was G. F. Nordenholt, editor of *Product Engineering*, New York, and the recorder was C. H. Slayton, Jr., General Electric Co., Pittsfield, Mass.

The Rubber Session

The first paper given before the session on rubber was entitled "The Practical Aspects of the Design of Structural Rubber Products" by Edward E. Blaurock, chief engineer, motor products division, U. S. Rubber, Detroit, Mich. Mr. Blaurock gave information on details required to produce low-cost, high-quality articles compatible with production materials and processes. He first defined the term structural rubber as those classes of elastic materials, natural and synthetic, which are applied primarily to resiliently isolate, transmit, or support various types of loads and forces. He gave a table of common functional and material design factors important to the design of any structural part and then covered, with regard to metal, analyses, manufacturing processes, attachment elements and tolerances; then size, weight, and shape factors of the whole part. The problem of adhesion, including fatigue and corrosion in bond regions, was next considered, followed by spring rate or load-deflection tolerances with special reference to the difference between the use of natural or synthetic rubber in the finished part. A discussion of finished part tolerances, protective coatings for both the rubber and the metal, and some points on the final finishing of the part concluded this paper.

The second paper, "A Simplified Method for the Design of Vibration Isolating Suspensions," by Robert C. Lewis, research engineer, Aero Elastic Laboratory, Massachusetts Institute of Technology, Cambridge, Mass., and Karl Unholtz, vibration engineer, MB Mfg. Co., Inc., New Haven, Conn., described a new type of chart treating of coupled natural frequencies of suspended bodies showing frequency ratios, nodal positions, and optimum selection of ratios directly in terms of physical dimensions of the body to be mounted. The characteristics of a newly designed family of isolator units were also described. Because of the extensive mathematical treatment in the paper, Dr. Lewis presented a review of the salient points with the aid of a demonstration model.

The third paper was entitled "Laboratory Testing of Rubber Torsion Springs" by D. H. Cornell and J. R. Beatty, physical research laboratory, The B. F. Goodrich Co., Akron, O. In an abstract the authors stated that the cylindrical rubber torsion spring consists of three essential members—an intermediate member of flexible rubber, securely bonded to two rigid cylindrical metal shells forming concentric inner and outer members. If such a spring is stressed in torsional shear, many advantages are realized, such as versatility of design, no static friction, inherent stability, and elimination of serious stress concentrations and of lubrication needs. Laboratory tests have been performed to establish the load deflection modulus, creep, and fatigue properties of rubber torsion springs. Other work has been done to a limited degree to investigate the effect of temperature on all of the above-named properties. Such a program necessitated the development of test methods for these particular investigations. Methods have been developed to find accurately and conveniently the static and dynamic moduli of any rubber torsion spring if its physical dimensions and the fundamental data of the rubber are known.

The final paper of the session on rubber was the annual review paper entitled "Advances in Rubber during 1946" and was given by E. F. Riesing, chief automotive engineer, Firestone Industrial Products, Detroit. The complete paper will be found on page 519.

The Plastics Session

The first paper of the evening session on plastics was "Mechanical Precision in Molded Plastics Parts" by S. K. Moxness, chief process engineer, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. In this paper Mr. Moxness emphasized that precision molding to tolerances of ±0.0015 per inch is possible when necessary, if careful consideration is given to such factors as mold construction, moisture content and uniformity of materials, preheating, length of curing time, speed and pressure of transfer rams, and post-conditioning of molded parts. For some parts the cost may be doubled by demanding such tolerances, but when economics permit it, such tolerances can be met, it was said.

The second paper was entitled "The Chemical Resistance of Phenolic Laminates" by W. R. Tyrie, materials engineer, General Electric Co., Lynn, Mass. An abstract by Mr. Tyrie stated that eight representative types of phenolic laminates were immersed in various aqueous chemical solutions for six months and tested periodically for weight change, dimensional change, and strength losses. Any laminate which has desired properties after prolonged immersion in water alone would also be satisfactory for other field conditions; the exception is strong acid condition or any alkaline condition.

The third paper discussed "Creep, Long-Time Tensile and Flexural Fatigue Properties of Melamine and Phenolic Plastics Materials." The authors were D. Telfair, assistant professor of physics and mathematics, Earlham College, Richmond, Inc.; C. H. Adams, chemist, and H. W. Mohrman, assistant director of research both of the plastics division, Monsanto Chemical Co., Springfield, Mass. In an abstract the authors state that tensile creep data for wood-flour filled phenolic and cellulose filled melamine indicate that these plastics exhibit similar characteristics. That is, the rate of elongation at 500 hours is essentially the same for the two materials. Likewise the total elongation at 1,000 hours is of the same order of magnitude for each of the materials. Similarly, asbestos filled phenolic and asbestos filled melamine show comparable tensile creep properties. The long-time tensile strength of the cellulose filled melamine is superior to that of the wood-flour filled phenolic material. The melamine has a long-time tensile strength of about 67% of the short time value (ASTM D 638-41T) as compared with a value for the phenolic of approximately 36%. Results of the repeated flexural stress tests indicate that the wood-flour filled phenolic plastic is very slightly superior to the cellulose filled melamine; the endurance limit for the phenolic is approximately 4000 p.s.i. or 34% of the short-time static flexural strength, and for the melamine 3000 p.s.i. or 31% of the short-time static flexural strength. Further tests of this nature would be desirable for the purpose of studying the effect of other fillers and formulations, it was said.

The final paper on the plastics program was the review paper entitled "Advances in Plastics for 1946" by Henry M. Richardson, DeBell & Richardson, Inc., Springfield, Mass. This paper is printed in full in the Plastics Technology section of this issue.

Executive Committee Meeting

A luncheon meeting of the executive, advisory, and general committees of the Division was held at the Hotel Pennsylvania on December 2. Mr. Booth, the retiring chairman, first presided over this meeting, but following the election of new officers for 1947, turned the meeting over to Mr. Richardson, the new chairman. Other officers for 1947 are: secretary, D. H. Cornell; and W. Newlin Keen, E. I. du Pont de Nemours Inc., Wilmington, Del., member of the executive committee. Mr. Keen was also appointed chairman of the program committee for papers on rubber to replace Mr. Cornell. F. W. Warner, Plastics division, General Electric, Pittsfield, continues as chairman of the program committee for papers on plastics.

In recognition of the contributions of Mr. Riesing, past chairman of the Division, to the growth and activities of the Division, Mr. Booth presented Mr. Riesing with a gavel constructed of rubber and plastics and suitably engraved. Mr. Riesing then in turn, presented Mr. Booth with a similar gavel in recognition of his service as chairman during 1946.

J. F. Downie-Smith, of United Shoe Machinery Corp., Beverly, Mass., and research secretary of the Division, brought up the matter of publication of the paper he has been preparing for the Division on problems on rubber of interest to engineers. It was decided to make one more effort to secure additional comments on this list of problems and following this arrange for publication of this paper. A similar paper on plastics problems is being prepared by Gordon Kline, of the National Bureau of Standards.

It was decided that the Division should participate in the semi-annual meeting of the Society at Chicago with two sessions and in the annual meeting at Atlantic City with four technical sessions. M. E. Lerner, editor, *Rubber Age*, was appointed chairman of publicity for the Division for 1947.

Buffalo Group Elections

THE Buffalo Rubber Group held a dinner-meeting on December 10 at the Hotel Westbrook, Buffalo, N. Y., with an attendance of 88, including nine guests.

Officers for 1947 proposed by the nominating committee and elected by the Group were: chairman, A. H. Davis, Dunlop Tire & Rubber Corp.; vice chairman, E. R. Briggs, Hewitt Rubber; secretary-treasurer, D. Meier, also of Dunlop; and executive committee, J. L. Legler, National Aniline Division, Allied Chemical & Dye Corp.; W. Parsons, Carborundum Co.; P. B. Schmitt, Pratt & Lambert, Inc.; N. J. Cyphers and T. Zinter, both of Hewitt; D. Bradly, Commercial Chemicals, Inc.; K. C. Greir, Chevrolet Motor & Axle Division, General Motors Corp.; H. Deney, Pierce & Stevens, Inc.; and E. C. Siverson, Buffalo Weaving & Belting Co.

There were no guest speakers at the meeting, which was preceded by a cocktail hour. Entertainment was provided, and all attending were given prizes by vendor and member organizations. The date and place of the Group's next meeting will be announced later.

N. Y. Group Christmas Party

SOME 540 members of the New York Rubber Group attended a very successful Christmas party on December 13 at the Hotel McAlpin, New York, N. Y. The election of officers for 1947 followed the dinner, which was preceded by a cocktail hour. At the request of Chairman George J. Wyrough, a slate of candidates was presented by the nominating committee, consisting of S. M. Martin, Jr., of Thiokol Corp., J. Breckley, of Titanium Pigment Corp., and J. Provost, of United States Rubber Co.

Group officers elected were: chairman, Simon Collier, of Johns-Manville Corp.; vice chairman, J. E. Waters, General Cable Corp.; sergeant-at-arms, G. C. Maassen, R. T. Vanderbilt Co., Inc.; and secretary-treasurer, B. B. Wilson, of India RUBBER WORLD. New members elected to the executive committee were Jean H. Nesbit, of U. S. Rubber Reclaiming Co.; G. S. Haslam, N. J. Zinc Co.; and D. E. Jones, American Hard Rubber Co. Retiring chairman George J. Wyrough, of Whitehead Bros. Rubber Co., and the retiring secretary-treasurer Peter P. Pinto, of *Rubber Age*, as customary, became ex-officio members of the executive committee.

After elections, the meeting was turned over to Mr. Pinto, who introduced the mistress of ceremonies for the lengthy entertainment program which then followed. Concluding the party was the distribution to holders of lucky numbers of 92 valuable prizes, made possible by the contributions of the many member and supporting rubber and supplier companies of the Group.

New Industrial Adhesive

A NEW industrial adhesive that requires no catalyst or special preparation for use was announced by G. E. Conde, director of research at the finishes laboratory of E. I. du Pont de Nemours & Co., Inc., at Parlin, N. J. Designated as No. 4665, the cement was described as being tough and flexible and suitable for bonding metal foils and metal sheets to wood, plastics, vulcanized natural, and synthetic rubbers as well as other substances having widely different coefficients of thermal expansion.

No. 4665 cement, as supplied, is an opaque, tan colored liquid, drying to a brown adhesive film. Aging or continued heating will raise the melting point of the film; the cement therefore has some thermosetting properties. It is insoluble in water. Continued and prolonged immersion will result in some, but not serious, reduction in bond strength, with original strength being recovered after removal from immersion. The dried film is resistant to dilute alkalies and acids and to corrosive salt solutions. It is not attacked by petroleum or coal-tar solvents, lubricating oils, alcohols, ethyl glycol, or vegetable oils. For thinning or for cleaning application equipment, the use of methyl ethyl ketone is recommended. The cement contains 27.5% total solids. It is soluble in ketones and ester solvents, but is resistant to mildew and fungi.

The cement may be applied by brush, knife, or roller coating, or by dipping, but is not recommended for spray application. Thinning is not ordinarily required; the viscosity is such as to return a very satsfactory film uniformity when properly applied. In addition to eliminating the need of catalysts and for high-speed agitation, an outstanding property of the new cement is its six months' minimum package stability with no tendency to gel within a year.

For bonding two porous surfaces, two non-porous surfaces, or a porous to a non-porous surface, the new cement is expected to find applications in many industrial fields, including metals, woods, plastics, ceramics, fabrics, rubber, paper, leather, plaster, concrete, and glass.

Wartime Allocations of Pyridine

DATA on the wartime allocations of pyridine for the 18-month period, January 1, 1944, to June 30, 1945, have been released by the Bureau of the Census, United States Department of Commerce. The data represent wartime distribution with allocations permitted only for identifiable military uses and other essential requirements. Statistics cover chemically pure pyridine and any crude or refined mixture of pyridine and its homologs.

During this period 3,049,000 pounds of pyridine were allocated, of which 386,000 pounds were for end-use in the manufacture of rubber chemicals. From January 1 to June 30, 1945, 956,000 pounds were allocated, with 127,000 pounds used for rubber chemicals. Of the 1,045,000 pounds allocated during the second half of 1944, 157,000 pounds were used in rubber chemicals. From January 1 to June 30, 1944, 102,000 pounds were used for rubber chemicals out of the total allocation of 1,048,000 pounds. Rubber chemicals were the third greatest use of pyridine, with vitamins and sulfa drugs first and second, respectively.

Perbunan Stabilizer Changed

ENJAY CO. (formerly Stanco Distributors, Inc.), 26 Broadway, New York 4, N. Y., has announced that Perbunan now contains a new stabilizer which helps reduce staining and discoloring to a very great extent. All Perbunan manufactured after December 1, 1946, has this improved property.

Laboratory and factory tests indicate that Perbunan 26 NS may be substituted directly for the older grade of Perbunan 26 without change in processing characteristics. Perbunan 35 NS is a somewhat softer and more processable polymer than Perbunan 35 HPLE, and the company's tests indicate that it can be substituted directly for most applications. Perbunan 18 originally contained the best non-staining stabilizer which could be used for this polymer, and there has therefore been no change in this rubber. Inspection of shipments of Perbunan made after December 1 will indicate that it has a light amber color. To avoid confusion the letters "NS" have been added to the identifying number on each carton.

The company states that this change in stabilizer makes possible the use of Perbunan in light colored articles and where delicate colors are desired. It will also make it possible to use Perbunan as a plasticizer and processing aid for polyvinyl chloride compounds in either plain or colored products. Tests have indicated that the new Perbunan should be satisfactory for gasoline dispensing and distillate hose.

New Agricultural Chemical

A NEW agricultural chemical for use against fungi, insects, and pests owes its remarkable effectiveness to the long enduring rubber-like film it forms upon treated surfaces, according to the B. F. Goodrich Chemical Co., Cleveland, O. The new chemical, one of a group known by the trade name "Good-Rite," follows the recent entry of the company into the biochemical field and is now ready for commercial application following several years of development, research, and field tests. The material is not only an effective fungicide when used alone, but an outstanding assistant to insecticides and other fungicides in these fields. Its adhesive properties hold the chemicals so that they cannot be washed away after application by rain or other moisture.

Supplied as a latex closely resembling dispersion of many synthetic rubbers now on the market both in appearance and physical properties, the chemical solution, when diluted with water, can be used with standard spraying equipment and conventional methods. Once dried, the material forms a microscopic web that can be removed only by scraping, decomposition of the chemical components, or expansion by growth of the treated surface. The film stretches to accommodate some growth after it has dried. With applications discontinued six weeks before harvest, no odor, taste, or other undesirable evidence of the spray remains on the fruit or vegetable to create any problem in marketing.

Basic material for the new chemical is polyethylene polysulfide. As a fungicide, when used by itself, tests have shown it capable of controlling most of the fungi which cause extensive losses on fruit trees. Sensational results have been attained by its use as a carrier and adhesive for other fungicides, insecticides, and penticides. When used as a carrier, it allows reduction in concentration of the conjunctive material because of the rapid build-up of spray deposits it makes possible, and the adherence of these deposits.

Hauser Discusses Rubber Ultramicroscopy

MEMBERS of The Los Angeles Rubber Group, Inc., met at Scully's Cafe on December 10 to hear Ernst A. Hauser, associate professor of chemical engineering at Massachusetts Institute of Technology, deliver a paper on "Recent Developments in Ultramicroscopy of Rubber."

In his talk, illustrated with colored slides, Dr. Hauser presented results of studies in the molecular weight distribution of *Hevea* rubber and various polymers, in which he was assisted by D. S. le Beau, director of research for Midwest Rubber Reclaiming Co. His conclusions were that ultramicroscopy with incident light afforded considerable advantage over electron microscope techniques.

"Microscopic as well as ultramicrosopic studies of rubber has so far been limited to the study of compounding ingredients in the rubber matrix," said Dr. Hauser.

These techniques call for an extremely thin preparation in order to obtain clear pictures. A few years ago a technique was devised to study lyophilic colloids with the electron microscope by depositing a solution on a very thin wire screen and allowing the solvent to evaporate. When used for rubber, it was possible to observe differences in the molecular configuration of the sol and gel fractions. It has also been proved that the electrons drastically affect the physical properties of lyophilic colloids like rubber. It has recently been possible to obtain very similar results by ultramicroscopy with incident light. This has the advantage of permitting the observation of chemical and physical reaction while the preparation is under investigation, without causing any changes in its composition. It furthermore permits studying any changes the preparation undergoes with time, something now possible with the electron microscope.

Members of TLARGI staged their annual Christmas Party on December 3 at the El Capitan theater in Hollywood, where they took over the entire performance of Ken Murray's "Blackouts." Following the performance, Marie Wilson, star of the show, presented gift radios and other electrical appliances to some 25 holders of lucky tickets.

Gehman Replaces Dillon On Editorial Advisory Board

S. D. GEHMAN, who heads the physical research section, Goodyear Tire & Rubber Co., Akron, O., replaced J. H. Dillon, formerly assistant director of the chemical and physical research laboratories, Firestone Tire & Rubber Co., Akron, and now director of research for the Textile Research Institute and the Textile Foundation, New York, N. Y., on the Editorial Advisory Board of India RUBBER WORLD, effective January 1.

Dr. Gehman received his bachelor's degree from the University of Pennsylvania in 1925, his master's degree in physics and mathematics in 1926, and his doctor's degree in physics in 1928, all from the same institution. He was an instructor in physics at Emory University, Atlanta, Ga., in 1925. He joined the physics research section at Goodyear in 1929, and in 1942 he was made head of this section. Dr. Gehman is the author of many papers and has been active in the American

S. D. Gehman

Physical and American Chemical societies as well as other engineering and professional societies. One of his recent papers, "Hysteresis and Methods for Its Measurement in Rubber-Like Materials," in which he was joined by Dr. Dillon, was published in the October and November issues of India RUBBER WORLD. Dr. Gehman will aid India RUBBER WORLD in the important field of the physics of rubbers and plastics.

Dr. Dillon requested the opportunity to resign from India RUBBER WORLD's Editorial Advisory Board because of the change in the nature of his activities, but has agreed to act in an unofficial capacity for us on matters pertaining to fundamental research in textiles.

Christmas Meeting at Boston

THERE was a record attendance of about 460 members at the winter meeting and annual Christmas party of the Boston Rubber Group held at the Copley Plaza Hotel, Boston, Mass., December 6. A cocktail hour preceded the turkey dinner, which was held in the main ballroom of the hotel.

James R. Geenty, Goodall-Sanford, Inc., chairman of the Group presided, and the first matter of business following dinner was the election of officers for the coming year and voting on two matters of policy. Officers for 1947 follow: chairman, Charles E. Reynolds, Cambridge Rubber Co.; vice chairman, R. K. Patrick, Vulplex, Inc.; secretary-treasurer, Bernard Copen, Tyer Rubber Co.; and new members of the executive committee, Owen Brown, Jr., Godfrey L. Cabot, Inc.; Harry Sutton, Boston Woven Hose & Rubber Co.; and Mr. Geenty. The members voted to increase the annual dues from $1 a year to $2 a year to take care of the higher cost of Group activities. The Boston Group members, however, voted against adopting a policy of having future meetings in the afternoon for the presentation of technical papers and then following this with the usual cocktail hour, dinner, and business meeting.

John Shackleton, plastics department, E. I. du Pont de Nemours & Co., Inc., gave a short talk on "Polyethylene," in which he first reviewed the development of this material by Imperial Chemicals, Ltd., of London, England. He mentioned that it was now produced by a continuous polymerization process in this country, and that it had been introduced in the United States in 1942 by the Navy Department, which set up two sources of supply. The speaker also described some of the special uses of polyethylene in electrical insulation, as extruded film, its use in packaging, and for tank lining. In connection with use in electrical insulation, Dr. Shakleton referred to a statement of the Okonite Co., which reported that for 18 out of the 23 properties desired of a material for use in electrical insulation, polyethylene could be classed as excellent.

It was stated that polyethylene could compete with lower-price resins in the 25 to 50¢ a pound range, even though the present price of polyethylene was 53¢ a pound. The advantages of polyethylene were then enumerated, i.e., a brittle point of—70° F., water absorption as low as or lower than polystyrene, water vapor transmission rate almost as low as vinylidene chloride, excellent electrical properties, and chemical resistance equal to or better than any other plastic except Teflon or vinylidene chloride. It was pointed out that polyethylene occupied a position midway between rigid and non-rigid plastics. Certain disadvantages were mentioned, including not too satisfactory abrasion resistance, high mold shrinkage and poor mold surface appearance, and high flammability. This latter characteristic can be improved, however, it was said.

In conclusion Dr. Shackelton said that he felt that the future for polyethylene was very bright, but that its price would depend on the volume used and this at present was not known. Although polyethylene was still in short supply, this situation was expected to be remedied within a year or so.

Following Dr. Shackleton's talk the Group was entertained by several fine acts of vaudeville. The last part of the program consisted of the drawing for prizes provided by generous donations of the rubber and supplier companies.

Retreading and Rubber-Working Machinery

INDUSTRY statistics for June, 1946, covering plants engaged in the manufacture of rubber-working and tire-retreading machinery, such as tire building machines, belt vulcanizers, and tire vulcanizing and recapping equipment, have been reported by the Bureau of the Census, United States Department of Commerce. These statistics are based on reports received from 12 plants, which are estimated to account for about 90% of the activity of the entire industry.

These 12 plants in the rubber-working and tire-retreading machinery industry shipped products valued at $2,627,000 and employed 4,014 persons during June, 1946. They consumed 3,294 short tons of carbon and alloy steel during the second quarter of the year. June shipments by the industry included rubber-working and tire-retreading machinery valued at $2,037,000 and other products valued at $590,000. Total machinery shipments of plants reporting amounted to $2,294,000, of which plants in other than the rubber-working and tire-retreading machinery industry accounted for $257,000.

New Navy Specification

ONE new Navy specification title, appearing since our previous listing in the December issue, is given below, in accordance with India RUBBER WORLD's policy to keep the rubber industry currently advised of changes in, or additions to, pertinent Navy Department and related specifications. Those members of the industry desiring copies of these specifications can obtain them upon request, giving title, number and date, from the Navy Department, Bureau of Supplies and Accounts, Washington 25, D. C.

The new specification is as follows:

Navy Dept. Spec. 33H7d—Hose, Cutting and Welding (Acetylene-Hydrogen, Oxygen-Air), date 15 October 1946 (1 page). (Amending Navy Dept. Spec. 33H7c, dated 1 March 1944).

Non-Ionic Surface-Active Agent

MODICOL L, a new non-ionic surface-active agent, has been developed by the National Oil Products Co. as an agent for controlling viscosity, particularly in latex compounds. When used in concentration of 0.1-1.0%, it maintains constant surface tension in the compounding of all types of synthetic latices and water dispersions of rubber. Modicol L is said to be a valuable additive in any compound where surface tension is an important factor, such as latex adhesives, pigment pastes, dipping compounds, and coagulants.

Detroit Group Elections

THE annual Christmas party of Detroit Rubber & Plastics Group, Inc., was held as a joint dinner-meeting with the Society of Plastic Engineers in the Detroit-Leland Hotel, Detroit, Mich., on December 13, with approximately 300 members and guests of both organizations attending.

The following 1947 officers were elected by the Group at the meeting: chairman, J. P. Wilson, Ford Motor Co.; vice chairman, C. W. Selheimer, United States Rubber Co.; secretary-treasurer, E. J. Kvet, Baldwin Rubber Co.; educational committee, Fred Wehmer, Minnesota Mining & Mfg. Co., and J. C. Dudley, Chrysler Corp.; membership committee, Fred Haushalter, Firestone Tire & Rubber Co.; program committee, Wm. Davies, Kaiser-Frazer Corp.; entertainment committee, Tom Halloran, Chemical Products Co., and George Horsful, American Cyanamid Co.; publicity committee, George Wolf, Sharples Chemicals, Inc.; advisory board, W. G. Nelson, U. S. Rubber, R. Shroyer, R. T. Vanderbilt Co., and J. C. Dudley, Chrysler.

Speaker of the evening was H. N. Stevens, research coordinator of The B. F. Goodrich Co., whose topic was "The Bikini Atomic Bomb Tests." The talk was illustrated by pictures of the bomb test results.

The meeting also featured entertainment consisting of musical and magical acts, and a simulated radio quiz show conducted by Ross Mulholland, of Station WJR, in which a number of the membership participated. Concluding the meeting was the distribution of a large number of prizes made possible by donations received from some 52 members and supporting companies.

Additional Experimental GR-S and GR-S Latices

ADDITIONS to the list of experimental GR-S dry polymers and GR-S latices available for distribution to rubber goods manufacturers together with certain reauthorizations of previously listed polymers from the Office of Rubber Reserve, RFC, under the conditions outlined in our November, 1945, issue, page 237, have been received and are listed in the table which appears below:

X-Number Designation	Manufacturing Plant	Date of Authorization	Polymer Description	Special Characteristics
X-334-GR-S	General, Baytown	10/7/46	Masterbatch containing 50 parts Philblack and 100 parts of a GR-S Type 10 polymer made at slightly higher temperature; Mooney viscosity 35 ± 5.	
X-335-GR-S	General, Baytown	10/7/46	25 parts Philblack and 100 parts of a GR-S Type 10 polymer.	
X-336-GR-S	General, Baytown	10/7/46	40 parts Furnex Black and 100 parts of a GR-S Type 10 polymer.	
X-337-GR-S	General, Baytown	10/7/46	50 parts EPC Black and 100 parts of a GR-S Type 10 polymer	
X-339-GR-S	Goodrich, Port Neches	10/1/46	Same as X-338 GR-S except that less rosin acid soap is used.	For same purpose use as X-338.
X-340-GR-S	U. S. Rubber, Institute	10/11/46	Same as GR-S-25 except that a different shortstopper is used.	For same purpose use as GR-S-25.
X-342-GR-S Latex	Goodrich, Louisville	10/3/46	X-309 GR-S latex with a higher water to monomer ratio.	A Type II latex with formulation especially developed for better tire cord adhesion.
X-343-GR-S	Firestone, Akron	10/11/46	A GR-S type-polymer made with lower water-to-monomer ratio, carried to a lower than usual conversion. Shortstopped with hydroquinone and stabilized with PBNA.	
X-344-GR-S	U. S. Rubber, Institute	10/25/46	A non-staining variation of X-285-GR-S containing 1.5 parts of IBUL.	This material should show superior processing, low shrinkage characteristics, and improved surface appearance. Exhibits faster curing tendencies and improved retention of physical properties after aging.
X-345-GR-S	Firestone, Lake Charles	10/29/46	GR-S Type 10 polymer made by continuous polymerization and coagulated with aluminum sulfate.	For same purpose use as GR-S-10
X-346-GR-S	Goodyear, Houston		Standard bale GR-S.	
X-348-GR-S	General, Baytown	11/5/46	Same as GR-S-Black-I except that carbon black loading shall be 46 ± 2.	Carbon black masterbatches are reported to have superior processing and handling characteristics; for use in stock requiring this type of material.
X-349-GR-S	Goodrich, Louisville	11/18/46	A copolymer made with a limited amount of Dixie modifier fed increment wise. Because of its high Mooney, heat softening is required to obtain satisfactory processing; polymerization temperature and conversion lower than usual. Coagulated with salt and acetic acid. Similar to German Buna S-3.	It is hoped that superior treadwear in tires made from this polymer will be exhibited.
X-351-GR-S	U. S. Rubber, Institute	12/6/46	Black GR-S containing 50 parts EPC black to 100 parts GR-S; Mooney viscosity 38 ± 5. Similar to X-298.	Carbon black masterbatches are reported to have superior processing and handling characteristics; for use in stock requiring this type of material.
X-352-GR-S	U. S. Rubber, Torrance	12/6/46	Same as GR-S-10 except that Mooney viscosity is between 45-55.	Slight improvement in Banbury or plasticator breakdown is to be expected.

Reauthorizations have been issued for the following polymers which were previously authorized made, and in consumers' tests found advantageous:

X-250-GR-S	Goodrich, Louisville	10/25/46	Regular GR-S at 45 ± 5 Mooney. Shortstopped with hydroquinone. No antioxidant.	General-purpose use.
X-274-GR-S	National Synthetic, Louisville	10/23/46	GR-S-10 shortstopped with sodium sulfide and stabilized with Stalite	For same purpose use as GR-S-10. Produced for materials where a special non-discoloring antioxident is required.
X-278-GR-S	U. S. Rubber, Naugatuck	10/23/46	50/50 butadiene/styrene ratio polymer made using sodium and glue emulsifiers, shortstopped with hydroquinone, 2 parts PBNA antioxidant, alum coagulated.	For use in closure and sealant compounds.

X-Number Designation	Manufacturing Plant	Date of Authorization	Polymer Description	Special Characteristics
X-285-GR-S	U. S. Rubber, Naugatuck	10/25/46	Butadiene/styrene polymer with an auxiliary chemical to produce high gel content in the polymer, shortstopped with hydroquinone and stabilized with 1.5 parts BLE; salt acid flocculated; 60 Mooney viscosity.	This material should show superior processing and very low shrinkage characteristics. For use in footwear stocks, wire insulation, extruded mechanical goods, and other types of products where these characteristics are desired.
X-317-GR-S	U. S. Rubber, Institute	10/22/46	GR-S-20 AC made with a nonstaining shortstopping agent using 1.5 parts EFED as stabilizer.	For use in goods where a non-staining antioxidant is desired.
X-315-GR-S	U. S. Rubber, Institute	10/22/46	Masterbatch containing 50 parts Silene EF and 100 parts of a 40 Mooney rubber, stabilized with 1.5 EFED.	For use in industrial products and specialties where this type of polymer is desired.

New Edition of Copolymer Safety Manual

THE Office of Rubber Reserve, RFC, has issued replacement material to convert its "Safety Manual for Operation of Copolymer Laboratories" into a second edition, dated December 18. Work on the manual began in May, 1945, when a subcommittee of safety supervisors was appointed to draft a safety manual for use in copolymer plant laboratories, as a result of a discussion of laboratory hazards and at the request of copolymer plant representatives at a Rubber Reserve Safety and Fire Conference. On July 28, 1945, this subcommittee submitted a draft, "Recommendations for Handling Butadiene in Copolymer Laboratories." Upon the indicated request of the copolymer operating committee, composed of representatives of the companies operating copolymer plants for Rubber Reserve, to have a more complete manual developed another subcommittee was formed, composed principally of technical supervisors and superintendents. This committee prepared the first edition of the safety manual, which was approved on a trial basis on February 5, 1946, at a copolymer operating committee meeting in New Orleans, La.

At a subsequent meeting of the committee in New York, N. Y., A. B. Pettit, then manager of Rubber Reserve's Safety Section, suggested that the subcommittee be reconvened to determine whether the operating experience of the plants would indicate the desirability of revising the manual. As a result of this suggestion, a subcommittee met in Washington, D. C., on September 30, 1946, and developed the new second edition. This revised edition was approved by the operating committee at its meeting in Akron, O., on October 24, 1946, which also discharged the subcommittee from further duty. Future matters in connection with the manual will be handled by the Safety Section of Rubber Reserve.

Part I of the manual consists of five sections. The first section, on general laboratory safety, is composed of 12 parts covering such topics as housekeeping, mechanical hazards, eye protection, first aid, laboratory clothing, etc. Section B, on physical testing laboratory safety rules and procedures, covers operations such as sampling, compounding and cutting rubber, and machines such as mills, presses, Mooney machines, tensile testers, extruders, and pelletizers. Section C, on chemical laboratory safety rules and procedures, consists of 20 parts covering glass handling, poisonous vapors and chemicals, use of hoods, mixing chemicals, storage of gases, and similar topics. The fourth section, on emergency procedures affecting laboratory operations, treats of procedures in case of fires of various types, spills of chemicals, breaking of containers, and similar accidents. The last section, on recommended safety features for construction of laboratory buildings, deals with structure, ventilation equipment, and fire protection of laboratory buildings.

Part II of the manual is entiled, "Safety in Handling Hydrocarbons." It covers handling, testing, storage, and disposal of the various hydrocarbons to be encountered, with detailed information on sampling bombs, including sizes, safety devices, valves and fittings, venting methods, and materials of construction. Diagrams of bombs, bomb racks, and sampling systems are appended. There are also appendices on safety holders and crates for stoppers and bottles and on toxicity of various materials.

The new second edition of the manual has changes only in Part II. The revised Part II shows a reduction in mandatory requirements, leaving only certain conditions relating to butadiene sample bomb design and handling as mandatory. In general, mandates are now limited to a minimum number of items. The sample bombs and related equipment shown in the diagrams are now to be considered as suggested forms of equipment, instead of the previous mandatory requirement. Another innovation is the inclusion of definitions of terminology used throughout the manual to denote mandatory, recommended, or optional requirements.

Southern Ohio Group Officers

THE results of a letter ballot election of officers for the recently formed Southern Ohio Rubber Group were announced late in December by Russell J. Hoskin, Inland Mfg. Division, General Motors Corp., acting secretary.

Officers for 1947 follow: chairman, Roger R. Hickernell, Inland Mfg. Division; vice chairman, Robert S. Radow, Dayton Rubber Mfg. Co.; treasurer, Louis J. Keyes, Dayton Rubber; secretary, Mr. Hoskin. Directors of the Group were elected for three, two, and one-year terms. Directors for three years are: Joseph Rockoff, Dayton Rubber; Herman E. Wening, Inland Mfg.; Edward C. Dill, of Inland Mfg. Directors for two years are: R. B. Appleby, E. I. du Pont de Nemours & Co., Inc.; S. L. Brams, Dayton Chemical Products Laboratory; H. W. Bell, Firestone Industrial Products Co. Directors for one year are: J. L. Fitzgerald, Premier Rubber Co.; M. E. Lerner, *Rubber Age;* R. G. Seaman, India RUBBER WORLD.

The next meeting of the Group has been scheduled for February 20 and is to be held in Dayton, O., at the Young Women's League, 24 W. Fourth St. This will be a dinner and business meeting, further details of which are not as yet available. This new Group reports a membership of 132 at the present time. The new officers request that as many members as possible plan to attend the February 20 meeting and that each of the charter members consider himself a membership committee of one to bring in more members.

CALENDAR

Jan. 10.	Philadelphia Rubber Group. Kugler's Restaurant, Philadelphia, Pa.
Jan. 14-17.	National Materials Handling Exposition. Public Auditorium, Cleveland, O.
Jan. 15-31.	March of Dimes.
Jan. 23-26.	Low-Pressure Division. Society of the Plastics Industry, Inc. Edgewater Beach Hotel, Chicago, Ill.
Jan. 25-31.	Plastics Show and Convention. Society of Plastics Engineers. Navy Pier and Congress Hotel, Chicago, Ill.
Jan. 27-Feb. 1.	American Physical Society. Annual Meeting. New York, N. Y.
Feb. 1-7.	National Sporting Goods Show. Hotel New Yorker, N. Y.
Feb. 4.	Los Angeles Rubber Group, Inc. Mayfair Hotel, Los Angeles, Calif.
Feb. 13.	Quebec Rubber & Plastics Group.
Feb. 14.	Chicago Rubber Group. Morrison Hotel, Chicago, Ill.
Feb. 14.	Connecticut Rubber Group. Winter Meeting. General Electric Co.'s Monogram Hall. Bridgeport, Conn.
Feb. 20.	Southern Ohio Rubber Group. Young Women's League, Dayton, O.
Feb. 21.	Akron Rubber Group. Mayflower Hotel, Akron, O.
Mar. 4.	Los Angeles Rubber Group, Inc. Mayfair Hotel, Los Angeles, Calif.
Mar. 2-5.	American Society of Mechanical Engineers. Spring Meeting. Mayo Hotel, Tulsa, Okla. League. Dayton, O.
Mar. 13.	Quebec Rubber & Plastics Group.
Mar. 24-29.	Philadelphia Motorboat & Sportsmen's Show. Convention Hall. Philadelphia, Pa.
Apr. 10.	Quebec Rubber & Plastics Group.
Apr. 14-18.	American Chemical Society. Spring Meeting. Atlantic City, N. J.
May 26-28.	Division of Rubber Chemistry, A.C.S. Spring Meeting. Hotel Cleveland, Cleveland, O.

Plastics Technology

Advances in Plastics during 1946[1]

Henry M. Richardson[2]

THE principal features of the plastics industry during 1946 were the consolidation of the developments made during the war years and their adaptation to peacetime uses. While capacity for the production of plastics had greatly increased during the war, there was continual shortage of all plastics relative to the demand for them. Nevertheless very large quantities of vinyl resin sheet, film, and coated fabrics were produced and distributed in the consumers market. Likewise, injection molded plastics distributed as consumers goods of all sorts were in greater demand than ever before. The most significant change here was the increased availability of polystyrene which appropriated many applications which had been previously molded of the cellulosics or the ureas. Far more plastics would have been produced except for shortages of raw materials resulting from curtailment of production in the coal and steel industries, which resulted in shortages of benzol, phenol, naphthalene, and by strikes in the chemical industry further reducing the supply of phenol, plasticizers, formaldehyde, and synthetic resins and compounds. There is in process an expansion of the capacity to produce synthetic resins which should double the 1945 output and be 3½ times the 1941 output and almost seven times 1939 (1, 2).[3] It is expected that supply and demand may come into balance some time during 1947, provided we have a free economy and are not beset by industrial stoppages.

Technical advancements consisted mainly in the public disclosure of new materials and processes which had been held secret during the war and a further advancement of those techniques which had been developed for the production of articles for military requirements.

Probably the greatest advances in materials were made in the field of thermoplastic vinyl polymers. We are all familiar with the development of flexible sheet, film, foil, and coated fabric, based on polymers and copolymers of polyvinyl chloride. While most of the vinyl resins were produced for the usual processes of compounding, extruding, and calendering, there were other forms of resin polymers appearing as latex (3) suspension in water, as pastes or "Plastisols" where the resin is suspended in plasticizer in the form of a paste, or "Organosols" (4) where the resin is suspended in a mixture of plasticizer and volatile non-solvent thinner or diluent. All three of these fluid types are used for the formation of sheet, film, or surface coats without the use of the ordinary extrusion and calendering equipment. This increases the versatility of these resins and adapts them to use in the leather and textile industries without the necessity of setting up the usual compounding and processing equipment characteristic of the rubber and plastics industries.

While polystyrene became available in much larger quantity, no outstanding technical improvements were noted, although the industry made progress in its technique of control, compounding, and fabrication. A very useful copolymer of styrene was brought out, called Plexene M (5), which has the water resistance of polystyrene and is superior in its strength, toughness, solvent resistance, and resistance to weathering. It is of particular interest, since its mechanical characteristics and its stability recommend it for many applications which heretofore could only be fulfilled by the thermosetting materials.

Methyl methacrylate, used for transparent enclosures on aircraft during the war, was found to be in larger demand for civilian uses, both as fabricated from sheet and as molded, than had been expected. Shortages of raw material prevented satisfaction of the current demands.

Polyethylene (6, 7) was developed during the war as a tough flexible low loss insulation for coaxial cable used in high-frequency electronics. The peacetime demand is for extruded film and foil and molded articles which make use of its flexibility, toughness, lightness, and moisture resistance. Since polyethylene is based on very abundant raw materials, it can be expected that its uses will greatly increase.

A close relative of polyethylene, polyfluoroethlyene (8), was announced under the name of Teflon. It is an extremely stable compound, unaffected by acids, alkalies, solvents, water, or temperatures up to 300° C. It has electrical properties similar to polyethylene, but it is rather difficult to mold, owing to its very high softening or sintering temperature which approaches its depolymerization temperature.

In the field of polyamids some new forms of nylon became available in limited quantities. Most interesting of these are the leather-like flexible sheets or molded products and the thin film or foil.

In the field of polyesters was further development of resinous plasticizers and of unsaturated alkyd resins to be used in combination with a vinyl monomer (usually styrene) for the production of low-pressure laminates (9).

In the field of cellulosic plastics, the use of gel lacquers (10) from cellulose acetate butyrate was disclosed. Also cellulose propionate was produced in substantial quantities.

In the field of thermosetting condensation resins, the melamines, ureas, and phenolics, there were changes in formulation brought about by the shortage of certain raw materials. For example, in the resins used for laminated products, there was a trend toward a higher utilization of phenol and a relative reduction in the consumption of cresols and cresylic acid.

The vulcanizable elastomers are considered as rubber rather than as plastics. Nevertheless significant developments during the year included combinations of synthetic rubber with various plastics (11-14), such as combinations of nitrile-type rubbers with vinyl chloride polymers and with phenolic resins, provided materials with unique and valuable characteristics.

The silicone resins underwent considerable development and study and are beginning to find commercial applications not only as electrical insulating materials (15) and bonding agents, but also as lubricants (16) and elastomers (17, 18).

Additional work on materials is reported including starch ethers (19), improved ion exchange resins (20), new furane resins (21), some work on protein resins (22-24), discussion of plastic properties as a function of molecular structure (25), reports of resistance of plastics to bacteria, fungi, insect, etc. (26, 27).

Applications for Plastics

Following the availability of larger quantities of vinyl resins has been a rapid advance in the use of vinyl resin films, both supported and unsupported, in the field of textiles, leather, and paper for use as protective apparel (28), upholstery (29-31), draperies, packaging (32-38), wallpaper (39), floor coverings (40), spray coatings (41-42), yarn and cordage (43).

The vinyl resins, the polyamides, and the cellulosics were fabricated by extrusion (44, 45) for many useful purposes as vinyl insulation on wire (46), Saran and nylon monofilaments (47), and extruded thin sheet (48).

As usual, one of the principal uses for synthetic resins was in protective coats (49, 50). The alkyd resins (51) predominate in this field, principally for paints and enamels for metal and wood (52). There was also some discussion on protective coatings based on vinyl resins (53, 54), the field of printing inks (55), and the use of hot melt protective coats in the packaging of metal parts (56).

In the field of adhesives no startling new things were presented although reports on earlier developments were published covering adhesives for paper (57), wood and metal (58), and the general field of resin bonded plywood (59-62).

Laminated products (63) were reestablishing themselves in the usual peacetime outlets of the electrical, furniture, and architectural fields. In addition there was published some work on the improvements of textiles (64) for use in laminated plastics, and on glass cloth laminates (65) bonded with melamine (66) or silicone (67) resins. Non-woven cotton webs (68) for laminates got some attention.

Following the development of the uses of unsaturated polyester copolymers for low-pressure laminating and the low-density sandwich construction developed during the war for radome and aircraft component structures, appeared a series of articles on honeycomb (69, 70), foam (71, 72), corrugations (73) and other means of reducing density; as well as reviews of the general method (74) and discussions of techniques (75), and specific applications (76). The postforming of laminates (77) which found many applications during the war was summarized in one article.

In the molding of thermoplastics there were interesting articles on methods of molding unplasticized vinyl resins (78), the injection of nylon (79), the production of lenses (80) from transparent thermoplastics, and some interesting articles on molded components for piano actions (81, 82).

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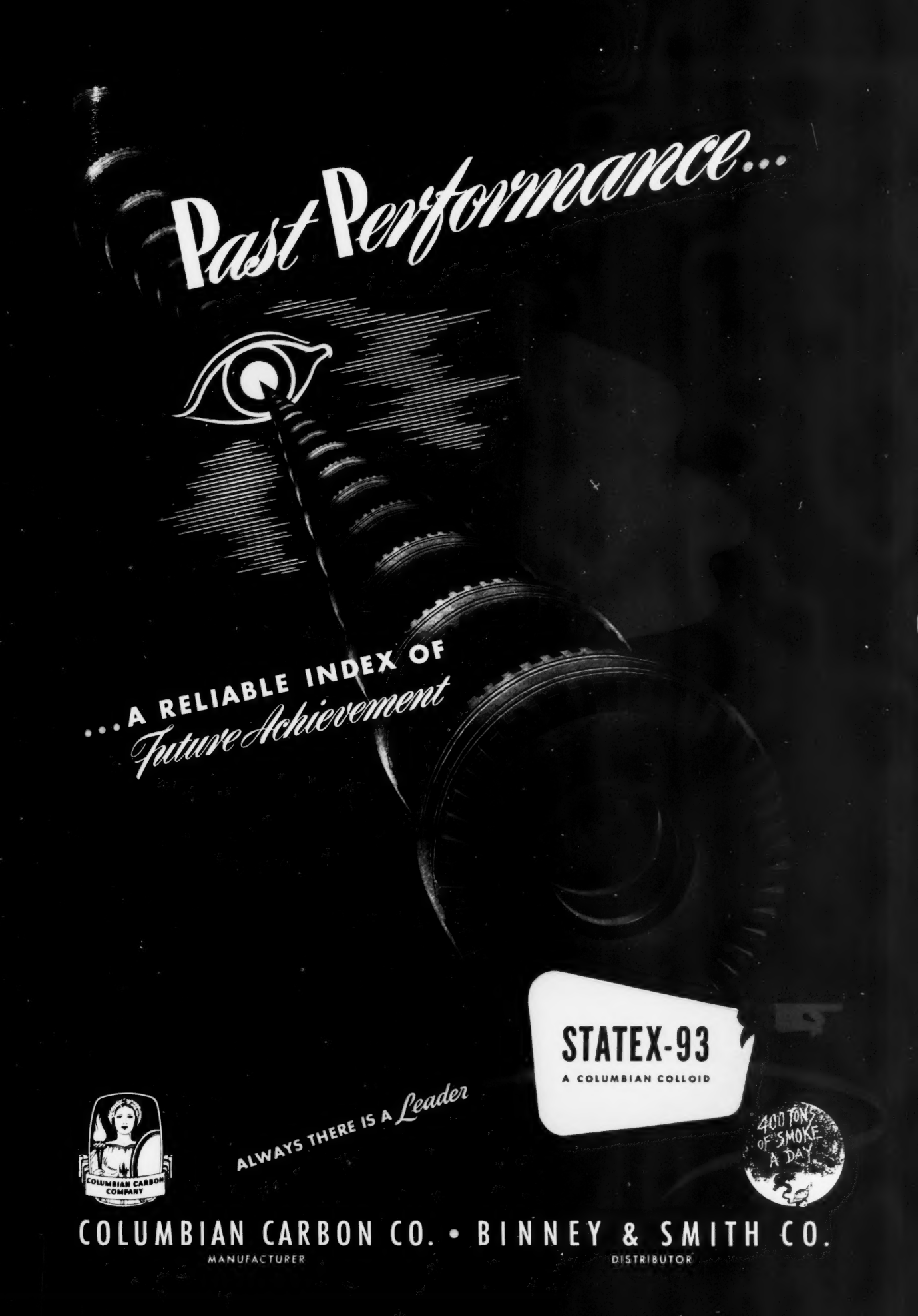
[1] Presented at the Rubber & Plastics Division of the American Society of Mechanical Engineers, Annual Meeting, New York, N. Y., Dec. 2-6, 1946.

[2] DeBell & Richardson, Inc., Springfield, Mass.

[3] Bibliography references appear at end of article.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Miscellaneous applications discuss the use of plastics, both molded and laminated, in lighting fixtures (83), the use of rubber and plastics in chemical construction (84), and a light fly rod (85) of resin bonded glass fiber. Testing of molded plastics (86) for impact strength (87), flow and cure (88), and effect of temperature and humidity on cellulosics (89) had some attention.

Equipment and Engineering

One of the most notable advances in the industry was the broad and general adoption of high-speed transfer molding of thermosetting materials with the aid of high-frequency electronic preheating. There was considerable development published relating to transfer molding equipment (90) and mold design (91, 92). Likewise there were reviews of injection (93) and compression (94) mold design, discussion of tolerances (95, 96) and the pressure requirements of molding (97) as a function of temperature, and type of thermosetting compound.

There were articles on heating operations (98), heating equipment (99, 100), and on hard chromium plating (101) for molds. Also considered were evaporative metal coatings (102) for plastics, and some interesting articles on design of plastic parts (103, 104).

Fabrication of sheet and film received considerable attention during the year (105), including new methods and equipment for electronic heat sealing (106) as well as the older processes of cementing (107, 108).

The annealing of polystyrene (109) and its fabrication by machining (110) also were discussed.

Cast plastics and casting processes (111) received some attention as well as the sealing of metal castings (112) and the impregnation of plaster with synthetic resins (113).

The major reference publications of 1946 included, as usual, "Modern Plastics Encyclopedia"; "The Directory of Materials, Products and Services" (114); Dr. Kline's series of articles on the German plastics industry appearing regularly in *Modern Plastics*; "German Plastics Practice" by DeBell, Goggin and Gloor (115); and "Plastic Mold Engineering" by DuBois and Pribble (116); and the series of Design Standards for Plastics by The Society of the Plastics Industry, including "Metal Inserts," "Tolerances," "Testing," "Cementing and Assembly."

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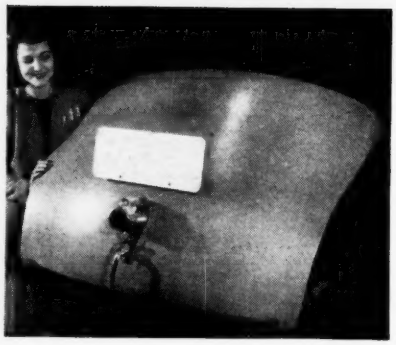
Low-Pressure Molding Resin

PLASTIC automobiles and boats are two of the future possibilities seen in a new low-pressure molding resin developed by chemists of the Goodyear research laboratory, Akron, O. The new resin makes possible the production of laminated plastics which are lighter than aluminum sheet, but possess greater tensile strength, according to L. B. Sebrell, director of the laboratory. Known as GRM-2, the new resin is a derivative of a complex organic glycol. One of the chief advantages of the new resin is that it can be molded at low pressures ranging from 15 to 40 pounds per square inch. It can be laminated with a considerable variety of materials, including paper and various fabrics such as canvas and fiberglass. The strongest plastics so far obtained have been by the use of glass fabrics. A laminated plastic of fiberglass and GRM-2 showed a tensile strength of 38,000 p.s.i., as compared to a tensile of 21,000 p.s.i. for aluminum, Dr. Sebrell said. Because of the low pressure moldability of GRM-2, it is possible to carry on the operation with the aid of inexpensive wooden molds. The usual process is to build up layers of fabric saturated with the resin over a form. The completed assembly is then transferred to the mold where pressure is applied with the aid of an inflatable rubber bag.

To date, two difficulties in manufacture have delayed the commercial utilization of the new resin. One is its tendency to stick to the rubber bag, and the other is that fumes created during curing cause deterioration of the bag. These difficulties have kept manufacturing costs too high, but both problems are expected to be overcome in the near future. It was pointed out that articles made of the new laminated plastic, such as automobile fenders, have many advantages over metal in that they will not rust or corrode and can stand more shock.



Plastic Automobile Trunk Lid Molded from GRM-2 Resin, Which Weighs 11 Pounds Less Than a Similar Metal Lid and Is as Strong

Rayon Laminated Plastics

A RECENT development in the use of rayon is the manufacture of an increasing variety of rayon laminated plastics, according to American Viscose Corp., New York, N. Y. Forms of rayon used for such plastics include woven fabrics, carded batts, ribbon lap, loose fiber, and thin sheets of non-woven fabric, depending on the particular characteristics needed and the method of handling or molding. In plastics, it is claimed, rayon not only imparts good tensile and high impact strengths, but also gives uniformity and clarity to the laminate produced. Through the cooperative efforts of the rayon producer, the fabricator, and the laminator, it is now possible to produce rayon laminated plastics for a large number of applications possessing desirable features not attained by other means.

Shipments and Consumption of Plastics and Resins

THE following statistics represent the shipments and consumption, in pounds, of plastics and synthetic resins for the third quarter of 1946, as reported to the Bureau of the Census, United States Department of Commerce, by 78 manufacturing companies and company departments. Data for synthetic resins for protective coatings are not included.

	July	August	September
Cellulose acetate and mixed ester plastics*	9,050,081	8,751,476	8,536,476
Nitrocellulose plastics*	1,523,777	1,538,915	1,515,330
Other cellulose plastics†	1,451,488	1,118,257	877,216
Phenolic and other tar acid resins:			
Laminating (dry basis)	2,338,486	3,068,525	1,936,652
Adhesives (dry basis)	1,199,637	1,481,024	1,526,767
Molding materials*	14,190,536	14,640,213	8,618,056
All other (dry basis)‡	4,977,055	5,949,009	3,993,668
	22,705,714	25,138,771	16,075,143
Urea and melamine resins:			
Adhesives (dry basis)	3,371,475	4,290,229	2,773,548
Textile and paper treating (dry basis)	1,303,859	1,475,196	1,119,799
All other, including laminating (dry basis)‡§	263,649	294,649	.....
	4,938,983	6,060,074	3,893,347
Polystyrene¶	5,746,830	5,725,860	5,347,902
Vinyl resins:			
Sheeting and film*	2,107,886	2,426,090	1,053,642
Textile and paper coating resins (resin content)	2,134,392	2,909,605	3,102,728
Molding and extrusion materials (resin content)	5,511,569	4,874,830	4,885,718
All other, including adhesives (resin content)‡	2,972,245	2,733,266	2,791,814
	12,726,092	10,943,791	11,833,902
Miscellaneous plastics and resins:*‡‖	10,099,210	8,142,986	7,653,068
Totals	68,242,175	67,420,130	55,732,384

*Includes fillers, plasticizers, and extenders.
†Includes methyl and ethyl cellulose and related plastics. This information represents a combination of molding and extrusion materials (statistics previously included with miscellaneous molding materials), and methyl and ethyl cellulouse sheets, rods, and tubes (statistics previously not published).
‡Excludes data for protective coating resins.
§Urea and melamine molding materials included with miscellaneous molding materials.
¶Dry basis, including necessary coloring materials.
‖Includes data for urea and melamine, acrylic acid, and miscellaneous molding materials, petroleum resins, acrylic acid ester resins, mixtures, and miscellaneous synthetic materials.

Goodrich Chemical Reduces the Price of Kriston Resins

B. F. GOODRICH CHEMICAL CO., Cleveland, O., has announced price reduction ranging from 50 to 70% for Kriston thermosetting resins. According to Sam L. Brous, sales development manager, the price reductions are concurrent with the start of operations at the new integrated pilot plant in the company's experimental station at Avon Lake, O. This new operation will provide the first commercial quantities of Kriston resins which are finding wide applications in the low-pressure laminating and cast plastics fields.

RUBBER WORLD
NEWS of the MONTH

Highlights—

Year-end statements by rubber industry leaders were generally optimistic for another year of record production during 1947, if the problems of labor relations, the supply of component materials, and distribution and prices are satisfactorily solved. Government control of the purchase of natural rubber and the control of the use of synthetic rubber are likely to continue during most of 1947, but both are dependent on the action of the new Congress in legislating and implementing a national rubber policy. Although it is estimated that the production of natural rubber during 1947 will not be equal to demand, there are some indications that the present conservative production estimates may be low. The Big Four rubber companies have agreed to meet with the United Rubber Workers of America, CIO, to discuss the union's demand for a 26¢-an-hour wage increase and to review the whole wage situation. The United States Rubber Co. and the Goodyear Tire & Rubber Co. have agreed to negotiate with the union on a company-wide basis, and negotiations with U. S. Rubber were conducted during December.

Another Record Year for 1947 Forecast

The possibility of another record year for the production of rubber goods was forecast by leading industry executives in year-end statements, and this same tone was taken in Washington by government spokesmen with regard to the general outlook for all business. Following their return from the meeting of the International Rubber Study Group at The Hague, George M. Tisdale, vice president of the United States Rubber Co., and John L. Collyer, president of The B. F. Goodrich Co., issued statements on natural and synthetic rubber consumption estimates for 1947 and called for a continuation of government controls of the purchase and consumption of natural rubber. Industry and government representatives met in Washington during the latter part of December to discuss further recommendations to Congress for continuing such controls until such time as Congress decides on a national rubber policy.

A continuing high level of production of natural rubber from Malaya during 1947 seems assured, and an improvement in output from the newly formed United States of Indonesia is likely. The possibility of another shortage of carbon black during 1947 was indicated. Earl Bunting, president, O'Sullivan Rubber Corp., was elected president of the NAM for 1947. Mr. Collyer received the War Department Medal of Merit for his service as Special Director of Rubber Programs.

Year-End Statements

Year-end statements by various industry leaders indicated a belief that the production of rubber goods during 1947 should equal or exceed that of 1946. The uncertainties of the government's rubber policy, the wage-price relation, and how soon accumulated demand in different products would be satisfied, were underscored as major factors influencing peak activity in manufacturing.

Herbert E. Smith, president, U. S. Rubber, pointed out that although the rubber industry produced a record peacetime volume of goods in 1946 and is expected to repeat this performance, or better it, in 1947, the pent-up demand for rubber products is such that shortages will continue for many months. Indications are that final sales figures will show that the industry in 1946 produced goods valued at 2.3 billion dollars, which was more than double the volume of 1940, the previous record year of wholly peacetime output, Mr. Smith added. It is estimated that sales in 1947 will be 2.3 to 2.5 billion dollars.

The demand for tires is still greater than the supply, and dealers find it impossible to build up inventories. This situation will probably continue during the first three to six months of 1947, but during the second half supply is expected to be more adequate. Rubber footwear, both waterproof and canvas, is being produced in increasingly large quantities, but it will be some months before depleted retail stocks are brought up to normal levels. The demand for rubber clothing and coated fabrics will continue to exceed supply for many months. The supply of golf balls and bathing caps will remain tight, although these articles will appear in much larger numbers than in 1946, it was said. Lastex yarn will be short in the first part of the year, but will be more plentiful in the latter half. Industrial products, such as belting and hose, for which demand still far exceeds supply, probably will be short all year.

In 1947 for the first time in four years the industry will use more natural rubber than synthetic. Consumption of natural is expected to be about 51% of the total. This figure compares with 22% in 1946. Total consumption of rubber in the United States in 1947 is estimated at 980,000 tons, of which 502,000 tons will be natural and 478,000 various kinds of synthetic rubber. Total consumption in this country in 1946 was slightly more than one million tons.

The greater part of the 1947 tonnage will go into tires, which will be manufactured in almost as great quantities as in 1946, when output reached record proportions. In that year, 88 million units, of which 66 million were passenger-car tires, were expected to be produced. The 1947 forecast is for a total of 80 million units, with 62 million for passenger cars, Mr. Smith concluded.

P. W. Litchfield, chairman of the board, Goodyear Tire & Rubber Co., in his statement first referred to the fact that the past year saw considerable progress toward untangling our national economy from its wartime controls and impediments. Much, however, still remains to be done in this direction.

Production of peacetime goods in 1946 was at a high overall total volume, but far from uniform or balanced. Sharp increases in production costs and sales prices have occurred in recent months, and there are now strong indications of buyer resistance.

By reason of an unusual combination of circumstances, tire prices were held at reasonable levels as compared with 1941, and an outstanding job of production has been done by the tire industry. In the face of threatened material shortages and disrupting strikes among suppliers of materials and services, the total output of the tire industry in the United States amounted to more than two new tires for every passenger car on the road. (And they are good tires, too, Mr. Litchfield added). Even so, the tire demand remains in excess of supply and will continue in this condition for a part of 1947.

Overshadowing all normal economic considerations bearing upon general business prospects for 1947 is the unsettled state of relations between employers and employes in the mass industries. Unless the trend toward higher production costs is speedily reversed and unless the threat of major strikes is removed, the prospects which otherwise seemed to be offered by 1947 will fall short of realization, this industry leader concluded.

Harvey S. Firestone, Jr., president of the Firestone Tire & Rubber Co., in his statement referred to 1946 as a year of progress in our economy, climaxed by substantial advances toward the restoration of free enterprise as the basic principal of American business. With the advent of 1947 we are still in the stage of catching up with accumulated demand.

As far as the rubber industry is concerned more tires were turned out in 1946 than in any other year of its history. However the rigid rationing of tires during the war years resulted in such an enormous backlog of pent-up demand that, even with the rubber industry running at full capacity, there are still not enough tires to supply everyone. Just when supply will catch up with demand depends on many factors over which we have no control. Unless unforeseen circumstances occur, it is reasonable to expect that by the Spring of 1947 car owners will be able to get the tires they want when they want them.

All of the elements essential to continued prosperity are here, Mr. Firestone explained. If we have the wisdom and the skill to make the best use of them, the potential demand will be tremendous. People will want and need the products of a very high level of employment. In the untilled needs of our own people we have all the economic "frontiers" we can handle for many years to come. Even though our living standards have been far higher than those of any other nation, many of our citizens have lived under substandard conditions. If we can find a way to distribute more of the good things of life to this portion of our population, we shall have a market which in size and permanence will far exceed the present huge war-born backlogs.

The people of this country have reawakened to the realization that we have

the world's highest standard of living, not by mere chance, but because we have built upon the foundation of free enterprise. Recent developments indicate that we are returning to the original concept of a free nation, a land in which a man may rise as high as his will and his skill will permit.

Now that we are regaining this freedom, the mantle of responsibility for providing full employment and maintaining and expanding the standards of living will again rest upon the shoulders of private industry. If free enterprise is to survive, industry must succeed, and a large measure of its success will depend on its ability to distribute the products of the factory, the forest, and the farm, economically, efficiently, and intelligently, so that more people may enjoy more of the good things of life, said Mr. Firestone.

Mr. Collyer, of Goodrich, first emphasized that America's rubber industry operated at an all-time high level of production in 1946. Total rubber consumption topped a million tons for the first time, with about 73% of that amount being American-made rubber.

Through most of 1947 we shall still be producing at top speed in meeting the yet unsatisfied backlog of demand for tires and other products. Our company's estimates are that in the coming year—assuming no serious material shortages or work stoppages and the production of five to six million automotive vehicles—total rubber consumption will be around 950,000 tons, Mr. Collyer said. This also would surpass even the peak wartime years and be considerably higher than any previous year other than 1946.

Best available statistics indicate that there will be no surplus of crude rubber, at least through the coming year. Rubber officials of the world's leading rubber-producing countries estimate total world consumption of rubber in 1947 at 1,700,000 tons; whereas total production of natural rubber is expected to be only 1,200,000 tons. Man-made rubber, of course, can and will make up the difference. It should be noted that for the year 1946 man-made rubber accounted for about 60% of the total tonnage of rubber used in the world, not quite so high a proportion as the 73% contributed by American-made rubber to this country's total use. However it is clear that as the supply of natural rubber becomes more able, in the late months of 1947 and subsequently, to satisfy America's rubber tonnage requirements, the need of maintaining the nation's facilities for production of American-made rubber will become less obvious.

Because of this fact the Goodrich company, in keeping with the position it took as early as 18 months before Pearl Harbor of calling attention to the importance of American-made rubber to national security, has been strongly urging prompt and decisive action, at the law-making level. The nation must make sure that adequate standby production capacity is maintained, and that there are certain minimums of both production and use of American-made rubber, regardless of strictly economic factors, even after the supply of crude rubber becomes almost completely sufficient to meet normal demands.

In addition to the national security need, maintenance of American-made rubber producing facilities even at modest levels of output can serve to lessen the hazard of high rubber prices resulting from cartels, which in the past have been reflected in the cost to American users of tires and other products and have caused rubber price skyrocketings that reached $1.23 per pound as recently as 1925.

Probably by the middle of 1947 the supply of passenger-car tires will be, barring unforeseen disturbances to production, in a fair state of balance with respect to demand. Even though total rubber consumption is likely to be less in 1947, the total units of tires should be about the same as for 1946—about 87 millions—because a larger proportion of them will be passenger-car tires. Of the expected 1947 total, probably 70 to 72 million will be for passenger cars and about 12 million for trucks and buses; whereas the 1946 totals are expected to be 66,700,000 passenger-car tires and 15,500,000 casings for trucks and buses. The remainder of the 87-million-unit total is accounted for by farm service, airplane, pneumatic, industrial, and motorcycle tires, it was reported.

W. O'Neil, president, The General Tire & Rubber Co., prefaced his statement with the remark that any rubber industry forecast for 1947 must necessarily be shrouded in misgiving due to the variable nature of supplies and most certainly of labor; yet it is not incomprehensible that the coming year will be the greatest that the industry has ever experienced, particularly production-wise.

But to attain this success the New Year must bring a full realization that the Tory thinking: "if you produce less, you have more" is plain hokum. The limiting of what a man can produce is just not good economy, and further elaboration of this thinking could have chaotic consequences with the nation's economy.

All of us working together in 1947 could make this one of the happiest years for the world's greatest nation.

Without question this New Year will be singularly marked from a production standpoint by the return of a greater, broader use of natural rubber with a subsequent decline in the use of synthetic.

While it is not our intention to find fault with the synthetic tire which performed such a great job for us during the war years, it is inevitable that more and more crude rubber will be returned to tires because it has been our experience that there is no substitute for rubber when it comes to building premium tires. Built with as much as 90 to 95% synthetic rubber, the war tire left plenty to be desired from a safety viewpoint, but that they carried our tremendous transportaton load throughout the emergency period at virtually a normal pace is a tribute to American ingenuity.

But the emergency period is ending now and the motorist has a right to demand a tire that can run at a lower pressure—and really perform the function for which rubber was originally put on automobiles. There should be no great shortage of ordinary tires in 1947, but production of premium tires will be unequal to the unprecedented demand, which the industry cannot hope to satisfy until some time in 1948 provided the nation's business goes ahead at a normal pace.

Shortly after the first of the year production will be permitted in General Squeegees in the 6.00 by 16 class. The greatest demand for premium tires comes from this source since the majority of cars on the road today require the 6.00 by 16 casings. Thus far shortage of rayon has prevented manufacture of tires in this size. General also plans to return its famous premium truck tire, the C. D., early in the new year—and this is another good reason why we are facing 1947 with so much optimism.

We do not anticipate any widespread price cutting during 1947—since supply will not have exceeded demand by a sufficient margin to warrant it. If current wage raise demands were to be granted, price increases would follow, Mr. O'Neil said.

Just how successful the tire business will be during 1947 depends entirely on the activity of the country. If during 1947 industry-crippling strikes go out of style, the rubber industry will move forward with one of the greatest demands on records, but if, on the other hand, the nation's activities are beset by difficulties such as we have experienced in recent months, the demand for tires will obviously diminish, and we will suffer accordingly.

While the demand for synthetic rubber will gradually lessen, it is only wise on our part to continue part of this industry for reasons of national security if for no other. Through synthetic rubber the United States was removed from dependency on the outside for one of its most vital commodities, rubber. Part of the cost of synthetic rubber has been political, and we can only hope that the right influence prevails in the future. Actually the cost of butadiene produced from an alcohol base was four or five times greater than that produced from a petroleum base which makes it quite obvious that plants equipped to produce the butadiene from a petroleum base should be retained in our future economy. It is quite likely that the rubber industry demand will be such that the petroleum-based plants will be capable of operating on an economically sound basis.

Even our need of synthetic rubber will be determined by the activity of the nation's business—and this could be tremendous if we work together during the year 1947 in the American way, Mr. O'Neil concluded.

J. P. Seiberling, president, Seiberling Rubber Co., in a special year-end statement declared that if the rubber industry is permitted to operate at full production during 1947—the important factors being the supply of component parts from other industries, and the supply of manpower—the nation will be well "over the hump" in supplying its vehicles with necessary tires and tubes by the year's end.

By this date a year from now, Mr. Seiberling believes that the pent-up demand for the products of the rubber industry will have been satisfied, and virtually every motorist will be properly supplied with necessary tires. This task alone will keep the industry operating at maximum capacity for the year.

But the problem does not end there. By late in 1947 we will have to begin the job of rebuilding inventories that have been depleted over a period of nearly seven years. Manufacturers, jobbers, and dealers must rebuild their stocks to provide a normal backlog of tires and to make it possible once again for motorists to select tires by brand and grade.

Most manufacturers in the rubber industry are refraining from building any but the standard quality, so-called "100-level" tire now, because it has been found that the nation's needs can be filled more quickly by concentrating on the manufacture of this one grade, which is suitable for most purposes. But Mr. Seiberling is sure that most tire manufacturers

will introduce a premium tire by late in 1947, when the demand is more nearly fulfilled.

These factors point to a period of at least two years during which the rubber industry will continue to operate at a very high rate of production and show clearly that this industry will be virtually immune to the immediate effects of any "recession" which may come during 1947 or even 1948, Mr. Seiberling concluded.

A. L. Viles, president of The Rubber Manufacturers Association, Inc., in his year-end statement pointed to the fact that the nation's rubber manufacturing industry—vastly expanded since 1941 to satisfy military demands—met the test of even greater peacetime needs in 1946, hanging up new records in every branch of production.

Thinking back to recurrent shortages of materials that plagued all industry through the early part of the year, rubber manufacturers look upon 1946 production figures with a feeling of achievement, Mr. Viles added. These figures provide an answer in the emphatic affirmative to the question that confronted every manufacturer as the rubber reconversion program moved into high gear a year ago. That was whether our vast wartime expansion of both manufacturing capacity and employment was sufficient to meet an extraordinary demand for rubber products which the public had found in such short supply for more than four years.

Tire rationing at the famine level during the war and the new-found freedom that an end to gasoline rationing gave travel-hungry motorists combined to saddle upon the industry its biggest backlog of tire orders in the history of automotive transportation. That the industry was able largely to satisfy this demand by the year's end with the output of a record 66 million passenger-car casings is a fair measure of the success of the reconversion program as far as tires are concerned, Mr. Viles stated.

Comparable public demand for rubber products in the **public health** field had threatened to inundate the industry a year ago. Rubber surgical goods, hospital sheeting, rubber drug sundries, and protective rubber footwear and clothing were in critically short supply as the war ended. Again the producers of these goods geared their output to the rising curve of rubber consumption and by the year's end had succeeded in substantially reducing the backlog of orders that had piled up during the war.

And last, but not least, the manufacturers of more than 50,000 mechanical rubber goods that flow chiefly into the other divisions of the American industrial machine likewise were able to step up production to new records. These goods included conveyer belting, V-belts, flat transmission belts, rubber packing and insulating materials, hard rubber products, latex foam, chemically blown sponge, dampeners, and all manner of other molded and extruded rubber goods.

While it was unprecedented demand that pushed production of rubber products to these levels, it is now clearly evident that this demand is carrying over into the new year virtually unabated in many lines, Mr. Viles declared. Supplies of both raw materials and component materials are steadily improving, and the industry has already proved its capacity to gear its output to the greatly increased consumer requirements of the postwar era. These factors taken with continuing demand indicate that the rubber manufacturing industry will approach its 1946 performance in many lines during the year ahead and very possibly equal to surpass it in others.

The industry's ability to step up its production to 1946 levels was traced to two factors. In terms of consumption, plant capacity in the field of tires and tire products is approximately 63% greater than it was in 1940 as the result of plant expansions and the addition of great quantities of new milling machinery, molds, and curing equipment during the war. In the second place, the number of employes in the rubber manufacturing industry has doubled since 1940, rising from approximately 150,000 to approximately 300,000 in 1946, including factory and office workers.

In reviewing the factors which had a bearing on the industry's production effort, Mr. Viles pointed out significant changes in the rubber use pattern that resulted from the progressive relaxation of controls over materials. During the war the industry was using, overall, 12% natural rubber and 88% manufactured rubber of the GR-S type. The current ratio for the industry as 1946 ended was 37% natural rubber and 63% manufactured rubber, with amounts varying in either direction in certain products under CPA specification.

At the same time the government limited production of general-purpose manufactured rubber to two types of GR-S during the war in the interest of obtaining maximum production for the Armed Forces. By the end of 1946 the nation's synthetic plants were producing 25 different types of butadiene-styrene copolymer for use by the industry in products requiring their special properties for improved performance. The year also saw the continuing downtrend in the cost of producing manufactured rubber. From slightly more than 23¢ a pound in 1945 (when the high-cost alcohol-butadiene plants were in operation) GR-S production costs, exclusive of amortization and administration, dropped to less than 14¢ a pound in 1946.

W. Stuart Landes, president, Plastic Materials Manufacturers' Association, Inc., in his year-end statement entitled, "The Outlook for the Plastics Industry in 1947," called attention to the fact that the plastic industry has become so integral a part of American industrial and family life that it can fare in the year ahead only as the nation fares.

The year that just closed was one of both achievement and disappointment. By August the industry had achieved a rate of production 40% above that of 1945, 900 million pounds, but the cumulative effects of the coal and steel strikes earlier in the year, to which were added serious shutdowns in the plastics and chemicals industry itself, caused production of some volume materials to decrease sharply late in the year. The effect of the second coal strike, which will aggravate serious shortages of basic chemicals derived from coal and coal by-products, will be to lengthen the industry's recovery from the earlier strikes, which it had been predicted in August would take an additional six months to a year.

Currently, plastics production is estimated to be about double that of 1941. Expansion of basic production facilities, when completed, may double the 1945 rate of production. The demand is three times the supply.

Although the shortages of basic chemicals and therefore of plastics materials have harassed the manufacturers, the molders, and fabricators since V-J Day, and will continue to be one of the major problems, new problems are arising that may assume greater importance.

Prices will constitute the foremost problem in 1947, as they will with business in general, because of the danger of overpricing and the possibility of setting the stage for a recession. Now that artificial controls have been lifted, the basic economic law of supply and demand again will regulate our economy. But the delayed problem of readjustment which we face and will continue to meet in the year ahead is fraught with violent disturbances. Instead of approaching the situation gradually and in an orderly manner, we have been accumulating inequities under pressure, and industries are being asked in some cases to meet excessive demands from employes. This situation is further aggravated by the scarcity and consequent competition for some raw materials such as molasses, cotton linters, coal-tar crudes, glycerine, formaldehyde, and castor oil—making it increasingly difficult for plastics materials producers to keep today's prices within a reasonable relation to those of prewar years.

It is more and more apparent that planned expansions in capacity for basic chemicals and plastics that were expected to be completed in 1947 will now run well into 1948 or later. Some previously announced projects of construction have been shelved because of lack of government approval, inability to obtain building materials or equipment, lack of assurance of adequate supplies of raw materials, insufficient financing due to rising costs, or increased caution on the part of management in the face of all of today's uncertainties. Projects that are going forward are faced with some of these same difficulties, particularly construction materials shortages and greatly inflated construction costs.

The problems that lie ahead of us in 1947, gigantic as they seem, will surely be met. Mr. Landes is optimistic for the long pull because he believes our system of free enterprise and our natural resources will continue to keep America in the van of progress. The plastics industry is still in its infancy, and we look for a sound steady growth. Although the road ahead is arduous, the opportunities are challenging, Mr. Landes concluded.

Continued Government Control Possible

Following the return of the United States delegation to the meeting of the International Rubber Study Group held at The Hague in November, there was increased activity in Washington in the form of meetings between industry leaders and some of the government agencies concerned with rubber to discuss when and how to terminate the present government controls on buying and distribution of rubber.

Almost immediately upon his arrival in New York from the Study Group meeting, Mr. Tisdale on December 6 held a press conference and issued a statement in which he declared that factual data and statements presented by the natural rubber producing nations indicate clearly a world shortage of this rubber during 1947, which will be most pronounced during the first half. This situation requires a continuation of public procurement and specification controls as are now contained in Rubber Order R-1, subject to periodic joint review by government and industry. Such a situation also illustrates

the great value of American-made rubber in serving our people as a balancing factor in rubber supply, Mr. Tisdale said. Its availability will prevent any decrease in employment or production in the large domestic rubber goods manufacturing industry.

Other nations have attempted to establish so-called free markets within certain broad regulatory limits, and such action has created considerable interest in the United States toward a similar step. However discussions at The Hague and in London developed information that until natural rubber is in adequate supply, such a move in the United States could only result in speculation and higher costs, Mr. Tisdale emphasized. Such higher costs brought about by short supply and speculation would have little, if any, influence on increasing production in the Far East since shortages of food and labor are the principal bottlenecks.

Mr. Collyer also made a statement in New York on December 6 on his return from the Study Group meeting.

"Although the conference produced talk of a surplus of natural rubber," he said, "that surplus will by no means be immediate. In 1947 the estimated world need will be for 1,700,000 tons of natural rubber, whereas the estimated production will be about 1,200,000 tons.

"This indicates that man-made rubber will have to make up the difference. In 1946 man-made rubber accounted for 60% of world production and in the United States 75% of the rubber consumed was man-made, and the country set an all-time consumption record of 1,000,000 tons," Mr. Collyer pointed out.

Reports from Washington during the latter part of December were speculative, but indicated a trend toward continued government control of the purchase and sale of natural rubber and of specifications for rubber products until at least July 1, 1947. On December 29 it was said that a recommendation had been submitted to Presidential Assistant John R. Steelman by his deputies calling for the continuation of the public purchase program of rubber until such time as Congress legislates an extension of present usage controls over rubber consumption. An announcement from the White House in approval of this recommendation was considered quite likely.

The reasons for continuing the public purchase program included the belief that if private trading in rubber were restored, without government control over rubber consumption, the national security objective of maintaining the synthetic rubber industry would be lost, and, in addition, prices for natural rubber might rise very high. In offering to terminate public purchase of rubber as soon as Congress takes positive action on usage controls, the Administration is thus giving Congress the responsibility for restoration of free trade in rubber, it was reported.

The White House statement on the public purchase of rubber is also expected to contain a specific request to Congress for the type of consumption control considered necessary. This is said to be a combination of the specification controls now in use and a certificate plan proposed several months ago by the Inter-Agency Policy Committee on Rubber.

In this connection the Office of Rubber Reserve addressed a letter to the rubber manufacturing industry on December 5, in which reference was made to CPA's letter dated November 20, 1946, enclosing copies of Form CPA 4488 (revised) relative to the new method to be used in applying for requirements of natural rubber, natural latex, GR-S, GR-S latex, and Butyl (GR-I).

In order to assure that each consumer promptly obtains permits desired in any one month during a quarter, the Office of Rubber Reserve requested that the procedure now in use with respect to requesting permits for GR-S and GR-S latex also be used in requesting permits for natural rubber, natural rubber latex, and GR-I, i.e., that requests to purchase all types of synthetic and natural rubber be submitted to the Office of Rubber Reserve, RFC, Washington 25, D. C., attention of Sales Department, and be mailed to arrive not later than the twelfth day of the month preceding that in which delivery is desired.

Since the processing of forms CPA 4488 for the first quarter of 1947 will require some time, the Rubber Division is establishing preliminary quotas for the month of January, and Rubber Reserve will issue January permits within the limits of such quotas upon receipt of requests, which should be submitted immediately, it was said. Final first-quarter quotas will be established by the Rubber Division after analysis of the forms 4488, and purchase permits for February and for March will adjust any discrepancies which may arise as a result of using the preliminary January quota as a basis for issuing January permits, it was explained.

ORR Report

The Office of Rubber Reserve made public during December its "Report on the Rubber Program—Supplement No. 1—Year 1945." This report, similar to the one issued about a year ago, was dated April 8, 1946. It contained a letter from G. B. Hadlock, executive director of Office of Rubber Reserve, addressed to the board of directors, in which synthetic rubber production for 1945 and natural rubber importation and distribution were summarized.

Sections of this report deal with a review of the rubber program, natural rubber, synthetic rubber, plant operations, synthetic rubber production costs, financial details, and an appendix which contains information on the German rubber industry.

Reference is made to the creation of the Inter-Agency Policy Committee of Rubber during 1945, and it is added that a policy decision on surplus plant disposal is now of prime importance, as is the coordination of policy throughout the various branches of government.

Approximately $3,600,000 was spent for research and development projects in 1945 under the general supervision of Rubber Reserve. Results were made available to parties participating in Rubber Reserve-sponsored agreements which provide for exchange of technical information.

At the end of 1945, GR-S was being produced at an out-of-pocket cost of about 16¢ a pound, and during the year GR-I was produced at an average cost of 16.3¢ a pound. The cost of GR-M was brought down to approximately 19¢ a pound, but increased thereafter as a result of curtailed schedules, the report states.

Production of synthetic rubber in government plants during 1945 totaled 801,888 long tons. In addition 18,903 tons of synthetic rubber were produced in private facilities to bring the total United States production to 820,791 long tons. The government production was divided as follows: GR-S, 717,688 tons; GR-M 36,332 tons; GR-I, 47,868 tons.

Plant Disposal News

It was announced on December 18 that the $43,000,000 neoprene (GR-M) plant in Louisville, Ky., which has a rated capacity of 40,000 long tons a year and which was operated during the war by E. I. du Pont de Nemours & Co., Inc., has been declared surplus and is offered for sale or lease by War Assets Administration.

On December 23 WAA announced also the sale of the Dow-Velasco plants, Velasco, Tex., to the Dow Chemical Co., Midland, Mich., for $35,155,000. The sale includes all the facilities of the huge magnesium plant except the magnesium metal-producing units; the styrene and Thiokol "X" synthetic rubber plants, which cost the government $17,096,825 and $1,386,737, respectively; and a 725-acre land tract northwest of Velasco, which cost the government $141,326. Total cost of all properties approved for sale was $48,998,272.

Then a day later, on December 24, WAA announced that it will dispose of two of three surplus butadiene plants. Offers to buy or lease were invited for all three plants, but only two offers will be accepted in view of a recommendation by the Inter-Agency Policy Committee that one plant be held in standby condition as a national defense measure. Which plant will be kept will be determined by the offers received. The plants are located in Louisville, Ky., Kobuta, Pa., and Institute, W. Va. They cost the government a total of $123,980,500 and have a combined capacity of 224,000 short tons of butadiene a year.

A Johnson City, N. Y., sole and heel manufacturing plant, sponsored by the War Production Board for operation by Endicott Johnson Corp., has been sold to that corporation for $1,750,000, WAA announced on December 26. The plant was built and equipped at a cost of $2,376,699. It was never placed in wartime production, but will be enlarged by Endicott Johnson for peacetime production and will provide employment for 600 persons.

The Natural Rubber Picture

More reports from the Far East and Europe having to do with the outlook and future prospect for natural rubber have been received. With regard to Malaya it is said that political unrest is not likely to be a serious factor in this area and that the present labor unrest will subside when the cost of living comes down and more food and inducement goods are available. A good rice harvest is anticipated, and more grain and clothing are moving into the country. If most of the available labor is used for the production of rubber, full prewar output is possible before the end of 1947, it is reported, but any intensive programs of rehabilitation, reclamation, and replanting, which are so important to the future of the Malayan rubber industry, are not likely to be realized.

Construction of a bulking plant for liquid rubber latex at either Singapore or Port Swettenham at a cost of about $500,000 is being encouraged by Latex Distributors, Inc., New York. Arthur Nolan, vice president and general manager of Latex Distributors, who was in Malaya during November and December, was arranging agreements with several produc-

ers so as to assure a continuous stream of latex for export to the United States. Mr. Nolan estimated that the United States would probably buy 30-50,000 tons of latex during 1947, and that American consumption would grow to 100,000 tons dry rubber content annually.

The lack of proper tidewater bulk loading facilities has been the bottleneck preventing the swift flow of large quantities of latex to the United States, according to Mr. Nolan.

"The only plant to get into operation in Singapore is unable to cope with all needs.' Another plant at Port Swettenham was badly damaged, and while rehabilitation is still progressing latex may not flow through it until the first quarter of 1947," he reported.

"Meanwhile, other American concerns are engaged in the preparation of bulk latex handling facilities in Singapore and Port Swettenham, but are hampered by shortages of materials and equipment."

Mr. Nolan said that his plant is expected to be ready by the middle of 1947. Meanwhile latex will be shipped in drums as soon as American buying policy permits a profitable market for drummed latex.

Political negotiations with regard to the future political status of Netherlands India are continuing. The second step in the formation of a United States of Indonesia was taken in Bali on December 23 when the provisional State of East Indonesia was proclaimed in the name of Queen Wilhelmina of the Netherlands. The new state embraces all of Netherlands India east of Java and Borneo, except New Guinea. The first step in organizing the United States of Indonesia was taken several weeks ago when an agreement, now approved by the Dutch Government, recognized the Indonesia Republic in Java, Sumatra, and some adjacent smaller islands.

According to one report it is not sufficient that the present Indonesian rulers guarantee existing investments. Will these rules in five or ten years be willing and able to fulfill this guarantee? Labor in the Netherlands India seems willing to cooperate in rubber estate operation, but estate coolies have suffered badly from undernourishment, lack of clothing, lack of sanitation, and general illtreatment by the Japanese. It is understood that on most East Coast of Sumatra estates, one-half to two-thirds of the number of coolies are available as compared with prewar. Of South Sumatra, nothing is known, and in some parts of southwest Java the whole population has disappeared. It is estimated that because of the poor physical condition of the coolies, worker productivity during the first three months after the start of rehabilitation will not exceed 60% of normal. In addition to food, textiles, and household goods will have to be made available since wages paid in money have little attraction if the needed goods cannot be purchased.

Damage to rubber plantings has not been great but in some areas processing machinery is needed. The Netherlands Indies "Rubberfonds," however, has quite large stocks of rubber machinery and equipment for rubber collection on hand in this region.

Just what bottom price of rubber will bring out native production in Netherlands India is difficult to determine, but is mostly dependent on the standard of living. Since inducement goods are scarce and high priced, this state of affairs will have a direct bearing on rubber prices for the immediate future.

Reports from London state that there has not been much buying of rubber either for internal consumption or export, but that buying at the rate of about 25,000 tons a month for delivery during the first quarter of 1947 should begin after the first of the year. Heavy purchases by the United States are not anticipated during the first quarter, and the price is expected to remain relatively stable at its present level.

The *London Times* during November in articles entitled, "Rubber in a Free Market—Limited and Temporary Rise in Price?", expressed the belief that if the price of rubber does rise above its current level under free market conditions, it cannot rise much, nor would any increase be lasting. Before the war the potential production of rubber was excessive, and it is asking too much of world consumption to absorb not only the prewar slack, but also the new U. S. synthetic output, it was said. Either there will be a fight with estate against the smallholder, and both against synthetic production — which, in the U. S. will have at any rate the partial support of the government—or there will be a new international agreement, according to the *London Times*. Such an agreement may not come next year or the year after, but there is little doubt that some scheme will be necessary ultimately. There is little doubt, either, that when the need arises another international rubber agreement will be reached unless there is a complete change in the attitude of the United States, it was stated. This latter is not, however, impossible, it was added.

With regard to natural rubber in the United States, it is of interest to note that Stanford University has received a grant of approximately $150,000 from the Office of Naval Research for an eight-month research project on natural rubber. The project to be carried on at Salinas, Calif., and in the university's laboratories, will be administered by the newly established Stanford Research Institute. Facilities to be used in the project include four government owned laboratories at Salinas and 340 acres of farm land there now planted with a wide variety of guayule strains. The object of the project will be to develop, through studies of guayule and other plants, new types of plants which will give such a large yield of rubber that they could, if necessary, meet the country's need of natural rubber without interfering with its food economy.

According to figures of the CPA Rubber Division, imports of natural rubber totaled 46,122 long tons for September and 36,735 tons for October. Stocks at the end of October were 200,861 tons. Some interesting information on imports, consumption, and stocks of natural rubber latex showed that although 1,231 long tons, dry weight of latex were received in August, no latex was imported in September and 671 tons in October. Consumption for August, September, and October was 549, 551, and 585 tons, respectively, and reexports during these months averaged about 100 tons a month. Stocks at the end of October totaled 3,961 tons, dry weight, of which 3,223 tons were in government hands and 738 tons held by industry.

Industry Activities

The past, present, and the future production rate of the rubber goods manufacturing industry has been covered quite completely by the year-end statements of various industry leaders. The RMA in its regular monthly report on tire production gave figures for October and the first ten months of 1946, which, it was stated, exceeded total annual production for any year in the past decade. Highest

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Estimated Automotive Pneumatic Casings and Tube Shipments, Production, and Inventory—October-September, 1946— First Ten Months, 1946-1945

	Original Equipment	Replacement	Export	Total Shipments	% of Change from Preceding Month	Production during Month	% of Change from Preceding Month	Inventory End of Month	% of Change from Preceding Month
Passenger Casings									
October, 1946	1,393,954	5,474,354	48,092	6,917,300	+22.96	6,666,470	+13.59	2,265,435	—12.40
September, 1946	1,188,161	4,397,694	39,777	5,625,632		5,869,047		2,586,035	
1st 10 mos., 1946	8,496,236	44,420,074	478,156	53,367,466		53,987,452		2,265,435	
1945	544,502	19,177,007	166,952	19,888,461		20,709,192		1,672,546	
Truck and Bus Casings									
October, 1946	480,443	970,450	64,989	1,515,882	+15.10	1,538,099	+12.76	775,591	— 1.12
September, 1946	448,169	810,371	58,438	1,316,978		1,364,004		784,347	
1st 10 mos., 1946	3,324,648	8,887,709	649,156	12,861,513		12,929,111		775,591	
1945	4,426,431	9,680,242	214,632	14,321,305		14,309,108		679,689	
Total Automotive Casings									
October, 1946	1,874,397	6,444,804	113,981	8,433,182	+21.47	8,204,569	+13.43	3,041,026	— 9.77
September, 1946	1,636,330	5,208,065	98,215	6,942,610		7,233,051		3,370,382	
1st 10 mos., 1946	11,793,884	53,307,783	1,127,312	66,228,979		66,916,563		3,041,026	
1945	4,970,933	28,857,249	381,584	34,209,766		35,018,300		2,352,235	
Passenger Truck and Bus Tubes									
October, 1946	1,882,247	6,538,256	113,140	8,533,643	+26.71	8,086,567	+10.97	4,107,859	— 7.37
September, 1946	1,640,506	4,998,283	96,083	6,734,792		7,286,936		4,434,596	
1st 10 mos., 1946	11,903,129	47,566,236	1,068,302	60,537,667		61,747,845		4,107,859	
1945	4,975,667	27,377,256	309,860	32,662,783		33,565,106		3,022,074	

previous annual output was achieved in 1940, when the industry produced 50,965,000 units.

October production reached 6,666,470 units in passenger-car sizes, and at the same time the industry went into its still abnormally low inventories to ship actually more tires than it produced. The RMA report put production for the 10-month period at 53,987,452 passenger-car tires, 12,929,111 truck and bus tires, and 61,747,845 inner tubes in both passenger and truck sizes. The detailed report is on page 543.

Another report by the RMA stated that rubber consumption in the United States continued its steady climb in October, rising to a record 96,370 long tons for the month. October consumption showed a 7.17% gain over September and an advance of 46.3% over the corresponding month in 1945. The detailed report, covering consumption of natural, various types of manufactured rubber, and reclaim appears below.

Carbon Black Shortage

A disquieting note entered into calculations for continued high level production of rubber goods with the announcement during December that a severe shortage of channel-type carbon black will continue throughout the next few months. O. J. Brown, Jr., general sales manager of Godfrey L. Cabot, Inc., in a statement on December 11 said,

"There is little chance to increase the stocks of channel blacks during the first six months of 1947. As a matter of fact, the tire manufacturers and those who manufacture other products using carbon blacks of this type have been living off stock in hand during 1946. Now we are at the bottom of the bin. There probably is less than one week's supply in the warehouse of the entire carbon black industry.

"Godfrey L. Cabot, Inc., and other companies in the carbon black industry right now are producing channel-type carbon blacks in the greatest quantities ever known; yet all resources of all carbon black manufacturers combined are insufficient to meet the demand.

"Consumption of channel black has exceeded supply in 1946 by about 10%, with the black available for shipment from current production. The insignificant inventory now existing is made up of grades that are not preferred quality.

"No modern tire can be made without channel blacks. That is how serious the problem which confronts us and the rubber industry really is," Mr. Brown said.

Production of channel-type carbon blacks is running at the rate of about 50 million pounds a month. In November, consumption was 64 million pounds a month, and January consumption is estimated at 66 million pounds. Stocks of channel black are about 22 million pounds. Furnace black can be used interchangeably with channel black in rubber, but in November furnace-black shipments also exceeded production. The monthly production of the various grades of furnace black is about 50 million pounds.

Collyer Receives Award

Mr. Collyer on December 18 in Washington, D. C., received from Secretary of War Patterson the Medal for Merit for his services in connection with the development and production of synthetic rubber during the war. This is the highest civilian award that the War Department issues. In his reply, Mr. Collyer said that while he was the recipient of the award, he recognized fully that it was meant for the industry and for the people who worked on synthetic rubber and its products.

The citation accompanying the award read:

"John Lyon Collyer, for exceptionally meritorious conduct in the performance of outstanding services to the United States in connection with the development and production of synthetic rubber throughout the period of the emergency, and as Special Director of Rubber Programs of the War Production Board from March 21, 1945, until July 18, 1945. Mr. Collyer, by his exceptional foresight, ability and energy, contributed materially to the development and execution of a program to provide the Armed Forces and the country with the rubber products needed in the war effort. This included the development of a synthetic rubber program, the manufacture of synthetic rubber, the establishment of a stockpile of both synthetic and natural rubber, and the saving of rubber on a nationwide scale. Since this nation was shut off from the great part of its normal rubber sources, it was faced with a critical rubber shortage. That this shortage did not become sufficiently large to cripple our war effort was due in large part to him. Mr. Collyer's services in this crisis reflect great credit upon himself and upon the country."

Among those attending the ceremony were: Col. David M. Goodrich, chairman of the board of the Goodrich company; Mrs. Collyer; T. G. Graham, J. J. Newman, and C. W. Vaught, Goodrich vice presidents; Waldo M. Semon, director of pioneering research; W. I. Burt, vice president, the B. F. Goodrich Chemical Co.; and Robert V. Yohe, president of American Anode Co.

Bunting NAM Head

Earl Bunting, president of the O'Sullivan Rubber Corp., was elected president of the National Association of Manufacturers for 1947. Mr. Bunting in a statement early in December pledged himself to carry out the NAM's new liberalized labor and public relations program and to take the same approach to all other national economic problems, dealing with them in terms of what is fair and in the interests of all.

If labor and other groups accept the NAM'S offer of cooperation in the same spirit in which it has been made instead of "clinging to selfish group interests," he said, the difficult and complex obstacles that exist can be overcome, and a "sustained period of prosperity" can be enjoyed.

"Current difficulties," he said, "are in many respects due to a stiff-necked attitude on the part of both labor leaders and management, as a result of which stockholders and workers are caught in the middle.

"Neither labor nor management exist in a vacuum; they coexist in a society. And never must we in business, or they in labor, forget that the public welfare must come first," Mr. Bunting also asserted.

Management-Labor Relations in the Industry

Two major items held the spotlight in the industrial relations field during December. One was the wage demand of the United Rubber Workers of America (C.I.O.) for a 26¢-an-hour increase, and the other was the negotiations between the union and the United States Rubber Co., exploring the possibility of writing an acceptable company-wide contract. A similar discussion has been agreed upon between the Goodyear Tire & Rubber Co. and the union, scheduled for January 7 in Cleveland. The Akron Goodyear local elected new officers during December. E. M. Kassalow, formerly of the national CIO office in Washington, has become director of the URWA, replacing A. L. Lewis, who will devote all his time to the union's increased educational campaign.

ESTIMATED RUBBER CONSUMPTION BY DOMESTIC MANUFACTURERS
(Long Tons)

October-September, 1946—Ocotber, 1945-10 Months Ended October, 1946-1945

	October, 1946					Ten Months Ended October		
		% Change from						
	Oct. 1946	Sept. 1946	Oct. 1945	Sept.* 1946	Oct. 1945	1946	% Change From Prev. Year	1945
Natural Rubber	35,359	+13.61%	+390.69%	31,123	7,206	201,410	+124.61%	89,669
Manufactured Rubber								
GR-S	49,225			47,880	51,804	537,262		501,848
Neoprene	4,650			4,011	2,780	36,122		36,972
Butyl	6,524			6,265	3,832	67,081		34,931
GR-A (N. Type)	612			642	251	4,885		7,490
TOTAL MANUFACTURED RUBBER	61,011	+ 3.76%	+ 4.00%	58,798	58,667	645,350	+ 11.03%	581,241
TOTAL NATURAL AND MANUFACTURED RUBBER	96,370	+ 7.17%	+ 46.30%	89,921	65,873	846,760	+ 26.21%	670,910
Reclaimed Rubber	26,162	+10.32%	+ 17.93%	23,715	22,185	226,884	+ 12.77%	201,183

*Revised.

Company-Wide Bargaining Discussions

Representatives of U. S. Rubber and the URWA began a series of meetings in New York, N. Y., December 9 to discuss the possibility of developing a company-wide contract. This is the first time any of the Big Four companies has agreed to consider the negotiation of a master contract and U. S. Rubber is seeking an improvement in "union discipline" in exchange for such a contract. It is understood that the union has in turn agreed to take certain steps to end unnecessary work stoppages and production losses by handling grievances through established channels rather than by wildcat strikes. These preliminary meetings continued throughout the weeks of December 9 and 16, but were then recessed over the holidays. No details of the results of these meetings have become available, and it is understood that progress was slow owing to the newness and magnitude of the job of negotiating such a master contract. Non-uniformity of hours, worker productivity, and wage rates in U. S. Rubber plants located in different parts of the country are among the most important problems requiring a solution acceptable to both parties before a satisfactory contract can be prepared.

It was announced early in December by L. S. Buckmaster, president of the URWA that the Goodyear company had agreed to start negotiating with the union on a company-wide basis and that the first meeting would be held in Cleveland, O., on January 7.

The Wage Increase Demand

Union officials met with representatives of the Big Four in Philadelphia, Pa., on December 6 to determine whether or not the Big Four contract of March, 1946, would permit reopening the wage question before March, 1947. Prior to this meeting the companies emphasized that their willingness to reopen the contract did not mean that they believe a general increase is in order.

"In the interest of maintaining harmonious relations we offer to discuss the entire wage question," the companies told the union in a long telegram following the December 6 meeting.

"It is not to be inferred, however, that we believe a general increase or other changes are in order. Particularly since our wage rates are practically at the top of the mass production industries and our relative position in this respect has improved since March 2, 1946."

A second meeting between the Big Four and the union was held in Cleveland on January 3 for the purpose of deciding when the wage increase negotiations should start, where they should take place, and what should be included on the agenda for the next meeting.

It might be well to mention here that the national CIO union, of which the URWA is a part, released a report on December 11 by Robert R. Nathan, former government economist, in which it was concluded that wage increases are possible out of corporate profits without raising prices, that they are essential in order to maintain purchasing power, and that they are justifiable in order to restore real wages. Prof. Sumner H. Slichter, of Harvard University, immediately took exception to Mr. Nathan's conclusions in two articles in the *New York Herald Tribune*, and the National Association of Manufacturers on December 30 released a study of the Nathan report made by Ralph Robey, the Association's chief economist, in which Dr. Robey concluded that Mr. Nathan was wrong in his assertion that general wage increases are justifiable on the grounds that real wages have declined since January, 1945, that general wage increases are possible out of the excess profits of business, and that general wage increases are essential to maintain purchasing power.

Both Professor Slichter and Dr. Robey disagreed with Mr. Nathan's use of general averages of prices and wages. It was accepted that wage increases in many particular instances are justifiable, but it was pointed out that to advocate a systematic rise in wage rates throughout the economy is quite another thing. Said Dr. Robey:

"Thus Mr. Nathan's case that general wage increases are justifiable on the grounds that real wages have declined in recent months will not stand up under analysis. It is based on the suppression of statistics on the trend in wages and prices since 1939 and the misinterpretation of more recent trends."

With regard to Mr. Nathan's argument that substantial wage increases are possible out of corporate earnings, the NAM report concludes that Mr. Nathan's estimate of the present rate of corporate profits has no claim to validity; his assumption that present profits will continue cannot be accepted with confidence; the figure to which he proposes to reduce corporate profits cannot be accepted as a reasonable return, even if his figures were accepted, 40% of the wage increases he proposes would be paid out of the public treasury, and the 25% which he asserts as a possible wage increase for all corporations is merely a conjecture and in fact involves reducing corporate earnings to a point where return on risk capital is only microscopically better than return on riskless investment.

Dr. Robey also stated that Mr. Nathan's pretense that general wage increases are essential for the maintenance of purchasing power does not bear analysis, no matter which interpretation we give to it. If we assume he is protesting against business profits on this ground, he is wrong because business profits are a form of purchasing power which is used as rapidly as any other. If we assume he means to protest against shifts in individual incomes from one type of recipient to another, the figures prove his alarm is baseless; the only significant shift in individual incomes has been to increase the purchasing power of war veterans relative to the incomes of other classes.

Miscellaneous News

In Akron, O., Goodyear Local No. 2, URWA, elected George Milliron president in a run-off election which saw the defeat of C. V. Wheeler, six-time president of this local. The run-off election was necessary because candidates failed to obtain the necessary vote majorities in the original election held late in November.

Members of Akron Goodrich Local No. 5, URWA, went on record during December in favor of income tax reductions to all salary workers with incomes of $5,000 a year or less. Copies of a resolution to this effect were sent to President Truman and Congressman Walter B. Huber of Ohio.

URWA on January 6 completed negotiations on U. S. Rubber's company-wide contract, but no details are available as yet.

Revisions on R-1

Tire-type high-tenacity rayon cord, fabric or yarn, heretofore limited to certain specified uses, may now be used by rubber manufacturers for any purpose they desire. This action was taken December 17 by deleting list 15 to Appendix II to R-1 and follows removal of all other controls governing the manufacture, distribution, and price of high-tenacity rayon cord, fabric and yarn.

Previously Appendix II required that this material be consumed according to a preference pattern in such items as airplane tires, self-sealing fuel cells, military combat tires specially constructed to run after puncture, special-purpose and truck and bus tires, before it could be used in passenger-car tires of 6:50-inch cross-section. Use of rayon tire cord was not permitted in the popular 6:00-inch cross-section and smaller passenger-car tires.

Government tests have indicated that cotton tire cord is satisfactory in the smaller passenger-car tires where the generation of wheat is much less than in heavily loaded large truck and bus tires, CPA said. However the relaxation of controls will enable manufacturers to offer a passenger-car tire with rayon tire cord if they can get enough of that material, CPA added.

Lightweight bicycle tires used for racing now may be made with as high a percentage of natural rubber as manufacturers desire, and balloon bicycle tires may be made with 27% natural rubber, according to Appendix II, P-1, as Amended November 29, 1946.

Previously all bicycle tires had been limited to 13%. These increases, which will require a negligible amount of rubber, were permitted by one of eight minor changes in Appendix II, which were chiefly to clarify the language of the appendix and did not affect its provisions, officials of Civilian Production Administration explained.

Amendment 1 to R-1, as Amended November 15, 1946, permits, after December 16, spare tires and tubes on vehicles and also makes a change in the section dealing with the purchase by vehicle manufacturers of tires and tubes for original equipment, allowing a 15-day inventory.

Thirty-one consumer products and classes of products not in short supply or essential to the national economy were freed from retailers' and wholesalers' compulsory inventory control on November 26 by amendment of L-219 and Direction 1 thereto. Among the products affected are: drug sundries, phonograph records, radios, sporting goods, wheeled goods, toys, and games.

Sierra Rubber Co., Los Angeles, Calif, plans a factory building at 3706 E. 26th St., to provide 2,750 square feet of floor space, at an approximate cost of $7,000.

"Current Export Bulletin No. 381," issued November 27 by the Department of Commerce, Office of International Trade, Washington 25, D.C., adds to the list of products subject to the British Token Import Plan: household rubber gloves, waterproof clothing of all kinds (including blankets, baby pants, and crib sheets), varnished cambric insulating material, and rubber soling slabs. Bulletin 383, December 5, adds also elastic braid and rubber garden hose.

EASTERN AND SOUTHERN

Changes at Hercules

Luke H. Sperry since May, 1941, a member of the board of directors and since November, 1944, director of engineering for Hercules Powder Co., Wilmington, Del., retired December 31. Ernest S. Wilson, chief engineer, became director of the engineering department; while Ray N. Wheelock was made assistant director.

The retiring director, who was appointed chief engineer in 1939, previously had served as assistant plant superintendent at Hercules, Calif.; as plant superintendent at Emporium, Pa.; plant superintendent at Kenvil, N. J.; and manager of the chemical cotton plant at Hopewell, Va. Mr. Sperry entered the explosives industry 41 years ago and was associated with Hercules for 31 years. Educated at the Colorado University school of engineering, he supervised construction work at several of the plants to which he was assigned, besides handling details of plant management.

Mr. Wilson, a graduate of the University of Delaware, joined the engineering department in Wilmington in 1923. He served as general supervisor of plants for the paper makers chemical department from 1937 until 1939, when he was appointed assistant chief engineer of the company. He became chief engineer in November, 1944.

Mr. Wheelock was assistant chief engineer since April, 1945. His work in the Hercules engineering department has taken him all over the United States, to Mexico and France. After a year as mechanical and maintenance engineer at the Kenvil plant, he transferred to Carthage, Mo., in 1926, as maintenance engineer of the Hercules plant there. Two years later he was appointed construction engineer and went to Mexico to supervise construction of a dynamite plant. He returned to Wilmington in 1929, and as project engineer then worked at Hercules plants in Parlin, N. J.; Ishpeming, Mich.; Hercules, Calif.; Belvidere, N. J.; New River, Va.; and Louisiana, Mo. In February, 1942, he was named manager of Missouri Ordnance Works, a government plant operated by Hercules, where he remained until his appointment as assistant chief engineer in 1945.

E. S. Burke, president of Kelly-Springfield Tire Co., Cumberland, Md., has been appointed Cumberland chairman of the Committee for Economic Development, 285 Madison Ave., New York 17, N. Y.

Hutchman Co., Inc., Lakeland, Fla., is nearing completion of its citrus by-products plant designed to produce citrus seed oil, the first plant of its kind in the country. The oil will be marketed under the trade name of "Glo Seed Oil." It has been found to be particularly suitable for several industrial applications, including the manufacture of plastics, rubber articles, foodstuffs, special soaps, and skin preparations. The cost of the plant, when completed, will be in excess of $250,000. The company was recently incorporated at half a million dollars with I. E. Hutchman as president, and A. R. Carver as vice president.

Forms Coatings Department

Ernest Nathan, president of the Warwick Chemical Co. division of Sun Chemical Corp., has announced the creation of a coated finishes department and the appointment of Justus Hoyt as its manager. Mr. Hoyt, transferred to Warwick from Sun Chemical, makes his headquarters at Warwick's New York, N. Y., office.

The products sold by this department consist of resin coatings for coated fabrics as well as resin coatings for the manufacture of unsupported films. In addition to these, there are printing inks for unsupported films and concentrated color pastes for the coating industry.

Mr. Nathan also announced several other changes in personnel.

Ira S. Hurd, who came to Warwick last year after a varied experience in textile and chemical industries, is assuming the position of assistant sales manager in charge of textile sales and technical development.

David E. York has been made regional sales manager in charge of the Philadelphia office. Assisting him in the sales capacity is Max Lane; in a technical capacity, Robert T. McGuire. Mr. McGuire is a graduate of Lowell Textile Institute. His practical experience consists of laboratory and technical work with Pacific Mills, Southbridge Finishing Co., U. S. Finishing Co., Geigy Inc., Hercules Powder, and Ciba Co.

In New England the company has added Willard Brothers to its sales staff. He was with Wanskuck Co.-Geneva Mills before the war and after an honorable discharge from the U. S. Navy in December, 1945, entered Warwick's sales and technical training course to prepare himself as technical sales representative.

Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York 17, N. Y., will begin construction in the near future of units for the manufacture of Vinylite resins as an addition to its plant at Texas City, Tex. These new facilities will be erected on land owned by the company west of its present location between La-Marque and Texas City and will form a part of a general building program involving an expenditure of about $15,000,000. The project represents an extension of a plant expansion program begun in 1945, which includes the construction of a unit for the manufacture of butyl alcohol, extension designed to increase capacity for production of industrial organic solvents and anti-freeze compounds, and additions to the shop, laboratory and service buildings. Besides the company expects to construct a unit for production of ethyleneamines. H. M. Ross, superintendent, has stated that the new units will produce the basic resins which will be used by other manufacturers in the fabrication of finished Vinylite products.

Foster Dee Snell, head of the consulting firm, Foster D. Snell, Inc., 305 Washington St., Brooklyn 1, N. Y., has been elected an honorary member of the Chemical, Metallurgical & Mining Society of South Africa. He is also president of the American Institute of Chemists.

U. S. Rubber Changes

A new U. S. Tires district sales office has been opened at 988 Broad St., Newark, N. J., by United States Rubber Co., Rockefeller Center, New York 20, N. Y., to provide improved sales service to tire distributers in northern New Jersey and Staten Island, and William F. Regan has been appointed district manager. Mr. Regan, who joined the company in 1916, had been assistant district manager for U. S. Tires at the New York branch.

Charles William Pennington has been made sales manager of clothing and coated fabrics for U. S. Rubber, according to Chester J. Noonan, general sales manager of the company's footwear division. Mr. Pennington, sales manager of the Pacific Coast division since July, 1940, succeeds William F. Cairns, who will retire the Spring of 1947 after 42 years of continuous service with the rubber company. Mr. Pennington's headquarters will be in the Mishawaka, Ind., plant.

A native of New Albany, Ind., Mr. Pennington has been associated with the company since 1925, when he started in the Portland, Ore. branch. After a number of promotions, he became district manager of the Seattle branch in 1937. Seven months later he was made district manager of the San Francisco, Calif., branch.

Promotions of Herbert S. McWhorter to sales manager of the Pacific Coast division and of Louis J. Healey to district manager of the San Francisco branch were announced by Gregg T. Ward, branch sales manager of the footwear division. In his new position Mr. McWhorter will be in charge of footwear division sales in the Los Angeles, San Francisco, Seattle, and Denver districts. Mr. McWhorter, a native of Hattiesburg, Miss., joined U. S. Rubber in January, 1930, as a salesman in the New Orleans branch. In July, 1936, he was made district manager of that branch and four years later was appointed district manager of the San Francisco branch.

Mr. Healey started work in that branch as a sales clerk in August, 1939, becoming a salesman a year later. In August, 1941, he joined the U. S. Navy. Upon his return to the rubber company in February, 1946, he became district manager's assistant of the San Francisco branch.

New Products Reported

A new-type fire blanket, claimed a valuable safety and emergency aid to industrial plants, laboratories, hotels, and fire departments, is now being manufactured by U. S. Rubber. The blanket can be used as an emergency wrap if a person's clothing is aflame; as an auxiliary fire extinguisher to put out flames from vents, manholes, small containers or tanks; as a fire shield to permit approaching effective range of liquid fires; as a welding screen against welding rays and sparks; and as a salvage blanket to protect valuable materials from water, chemicals, and heat. The blanket, 60 by 80 inches in size, is made of high tensile strength glass cloth impregnated on both sides with synthetic rubber. Hems and seams are vulcanized, and folds are heat creased. The blanket is equipped with large brass grommets at the top and a weather-resistant bracket; so it can be hung up outdoors or indoors and easily removed or replaced. For quick identification, it is red in color and marked "Fire Blanket." Qualities claimed for the

blanket are that it is flameproof, heat resistant, chemical resistant, water resistant, mildewproof, verminproof, nonshrinkable, non-stretchable, and unaffected by heat or cold. Benson & Associates, Chicago, is distributer of this new blanket.

A new adhesive for sealing corrugated paper cartons has been developed by company chemists to speed up packaging operations and lower production costs. The new cement produces a permanent bond resistant to extremely high and low temperatures. It may be applied with a spray gun, thus saving time formerly required in applying adhesive materials by brush or in sealing the cartons with metal staples. The adhesive is economical to use because of the small quantity required for each carton. The product has a synthetic rubber base and will be known as U. S. Royal Adhesive M6165.

Improved rubber insulators which, the manufacturer claims, virtually eliminate noise from the interior of railroad cars are being produced by U. S. Rubber for use in new passenger cars now under construction. The rubber is placed between the truck and the body of the car, intercepting noise produced by the wheels rolling over the steel rails. New sleepers and coaches equipped with these insulators are said to be as quiet as the average living room or office. Known technically as mountings, several different types and sizes of insulators are required on each car, with one type supporting 70,000 pounds of weight. They are designed to withstand millions of flexings under high stress without distorting permanently from their original shape. While rubber mountings were used on some railroad cars before the war, the new insulators have been redesigned to provide more complete elimination of noise and vibration.

A bottle carrier that will aid in preventing accidents and burns in laboratories and industrial plants is now being made by the company. Lightweight and shockproof, it is designed to carry glass bottles containing acids, caustics, dyes, stains, inks, and other liquids. The new carrier is available in both one gallon and five-pint or two-liter sizes. The outer bag is made of heavy duck impregnated on both sides with chemical-resistant synthetic rubber. All seams are vulcanized. Carrying straps of double thickness run completely under the carrier so that the load is properly distributed and supported. A locking device on the drawstring keeps the carrier closed and prevents splashing. Other safety features include a firm disk base, a sponge rubber shockproof pad to protect the bottom against blows, and tubular sponge rubber side padding which completely surrounds the bottle. All are removable for cleaning. Benson & Associates, of Chicago, will be distributers for the bottle carrier.

Automobiles wearing wings have been introduced by U. S. Rubber at its tire test proving grounds on a dry lake near Lancaster, Calif. By attaching a section of airplane wing to the side of a test car, the company's tire development department found it could conduct tire tests at speeds heretofore considered impractical and unsafe on a circular track. Use of the wing section counter-balances centrifugal force, enabling the car to race around a circular track at sustained speeds of 90 m.p.h. and more, without "scrubbing" the sides of its tires and with a minimum of danger to the driver. Arthur W. Bull, the company's director of tire development, explained that the wing section, when attached vertically to the side of the car, develops a side thrust just as an airplane wing develops lift. Without a wing section, a car racing around the circular track shows abnormal wear on the tire treads and makes it difficult to obtain accurate tire tests. Since the wings have been added, tire wear on this course has been practically the same as would be encountered on a straight highway, Dr. Bull said.

A rubber-covered egg basket has been developed by U. S. Rubber to reduce breakage during the collection of eggs from nests. The basket is made of lightweight steel wire coated with rubber. It is rustproof and has an open construction to facilitate cleaning. The new product was developed at the suggestion of poultry raisers who had seen a rubber-covered potato basket introduced by the company about six months ago to safeguard potatoes against bruising.

A cellular rubber for insulating refrigerators and freezing units was recently announced by U. S. Rubber. Available in hard or soft forms, the material is lighter than cork and more effective as an insulator. Other advantages claimed are that it will not absorb moisture and is resistant to fire, rot, acids, oil, vermin, and termites. It is especially recommended for refrigerator trucks where present insulating materials absorb hundreds of pounds of moisture adding to the weight of the vehicles.

Heavy Duty Naugahyde, a new plastic upholstery especially designed for heavy-duty transportation seating, is now being made by the company. The material provides extra bulk for greater durability and more luxurious appearance and is available in a variety of colors. Since it is 50 inches wide and put up in rolls 50 yards long, seat patterns can be laid out satisfactorily in any direction over a wide area. Advantages claimed for the new product are long wear, outstanding abrasion resistance, and excellent flexing and tailoring properties. The material is also said to be practically immune to the effects of perspiration, oils, sunlight, and weathering; can be cleaned with soap and water; will not get hard or crack; and will not bag or form wrinkles on deep spring soft seats. Present production is limited only by shortages of raw materials. Uses foreseen include seating in buses and trucks of all kinds, station wagons, convertibles, trolley cars, trains, and boats.

Plant production of Lastex yarn is now at top speed to catch up with demand, after being sharply curtailed during the war. The company expects that greater supplies of Lastex in the latter part of 1947 will bring about increased use of the yarn in all types of wearing apparel.

J. M. Huber Corp. Formed

On January 1 the various Huber operations, heretofore conducted as three separate companies, were merged into one, the J. M. Huber Corp., with no change in ownership or management. The former Huber Co., Inc., was the operator of clay mines and three clay refining plants in South Carolina and Georgia. This company also handled the Huber timber interests in Maine, consisting of over 150,000 acres of timberland from which the stumpage is sold largely to the paper and to the plywood industries.

The previous J. M. Huber Corp. was the producer of channel and furnace blacks, as well as natural gas, at Borger, Tex. The company was a substantial producer of natural gas, supplying all its own carbon black gas requirements plus a considerable volume of sales to pipe lines. Its production of crude oil was well over one million barrels annually from wells in Texas and Kansas, and the company has an extensive drilling program under way in Colorado. In addition to central offices at Borger, Huber maintains geological offices at Wichita, Kan., Denver, Col., and also at Houston, Tex.

J. M. Huber, Inc., has been best known to the consuming industries as the former selling outlet of the Huber carbon blacks, clays, and rubber chemicals. This company was also a leading printing ink producer with factories located in Brooklyn, N. Y., Bayonne, N. J., St. Louis, Mo., and Borger.

Under the merger the industrial products division has been set up to handle all pigment and chemical sales of J. M. Huber Corp. This division will shortly move its offices from 460 W. 34th St., New York, N. Y., to 342 Madison Ave., New York 17.

J. M. Huber, Inc., has added Edward J. Geise to its technical service staff. A chemical engineering graduate of Rensselaer Polytechnic Institute, Mr. Geise had previously been associated with United States Rubber Co. for 10 years at the Naugatuck footwear plant, where he had been chief chemist-footwear. He also had served as a member of the Rubber Footwear GR-S Technical Committee for its duration, 1942-46. During the war he organized and directed two seminar courses on rubber technology at Yale University for the War Training Program. He is a member of the American Chemical Society and its Division of Rubber Chemistry and of the program committee of the Connecticut Rubber Group.

O'Sullivan Rubber Corp., Winchester, Va., is written up in the November-December issue of *Link-Belt News*, published by Link-Belt Co., Indianapolis, Ind. The story describes in some detail the invention of the rubber heel by Humphrey O'Sullivan in 1896, and the origin, growth, and development of the rubber heel and sole company. A description of the modernization of the Winchester plant is also included. Old mixers have been replaced with No. 11 Banburys, and the carbon black unloading and distributing systems modernized by use of Link-Belt conveyer systems. The Cabot pelletized channel black is unloaded from the tank cars through an enclosed spout directly into the foot end of an enclosed dustproof and weatherproof conveyer system which delivers the black into a storage tank on the roof of the plant. From here, the black is automatically weighed and fed into the Banbury through an enclosed conducting system. After the mixing and milling of the rubber batch a new belt conveyer system handles the stock in a continuous milled sheet through an air-cooling tunnel up to machines which die-cuts the sheet into "biscuits," ready for the curing presses. Bulk handling of carbon black has increased efficiency and economy, in addition to eliminating air-borne particles of black which formerly interfered with production of colored and pastel stocks.

Voiles Promoted

J. C. (Jess) Voiles has been made division manager with jurisdiction over the entire East and Midwest territories, with headquarters at 295 Fifth Ave., New York, N. Y., according to R. H. Chase, vice president and general manager, Plant Rubber & Asbestos Works, San Francisco, Calif. With almost 15 years' experience at Plant Rubber, Mr. Voiles is thoroughly familiar with the policies, products, and personnel of the company. Prior to this promotion, Mr. Voiles had been chief engineer for the company, in which post he applied his specialized knowledge on the engineering and technical aspects of heat engineering. For years he has been closely identified with insulation installations in the oil industry, power and chemical, and other process plants, and in ship building. His college work was taken at the University of California.

Plant Rubber & Asbestos Works is one of the nation's leading 85% magnesia insulation manufacturers, with many industry-wide advances, such as "precision molded" 85% magnesia insulation products, and simplified thickness standards, to its credit.

Shell Chemical Corp., 500 Fifth Ave., New York, N. Y., has announced that a $2,500,000 expansion program expected to increase the company's capacity to produce methyl ethyl ketone and secondary butyl alcohol by 150% is now well under way. This expansion program is said to be directed chiefly toward the installation of facilities for the production of these chemicals at the corporation's Houston, Tex., plant. Maximum production is scheduled to be attained by the third quarter of 1947.

W. Murray Gall has joined the research staff of the rubber laboratory of E. I. du Pont de Nemours & Co., Inc., in Wilmington, Del. He is a graduate of New York University and for the past six years was associated with the American Hard Rubber Co., Butler, N. J., as a rubber chemist.

Acme-Hamilton Mfg. Corp., Trenton, N. J., has announced the opening of the new New York offices of the Acme Rubber Mfg. Co. and Acme-Hamilton at Suite 3005, Woolworth Bldg., 233 Broadway, New York 7, N. Y. Acme Rubber has been manufacturing industrial rubber products since 1902.

Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh, Pa., has appointed Samuel L. H. Burk director of industrial relations to succeed Erson V. Ogg, who recently resigned to serve as a private engineering consultant to industry. Mr. Burk for the past 12 years has been with the Atlantic Refining Co., serving as director of organizations and methods and during the war on leave of absence, had acted in consultant and executive capacities with three war emergency agencies. He is also the author of numerous papers on personnel administration and related subjects and co-author of "Manual of Job Evaluation." A native of Philadelphia, Mr. Burk was graduated from the Wharton School, University of Pennsylvania.

Manhattan Announcements

Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J., has announced that Joseph Glenn & Cons, Clifton Heights, Pa., is now its representative in the Philadelphia area. The Glenn organization will carry a stock of conveyer power transmission, and V-belts and hose of all types.

All 4,000 Manhattan employes by voluntary choice were given the opportunity of taking influenza injections in an effort to ward off the disease. The injections were given recently at the plant hospital under the direction of Dr. J. M. Keating, plant physician, to all employes who desired them.

For the fourth consecutive year Manhattan received honors from the National Victory Garden Institute, when the division this year received a certificate for "a genuine contribution to the National Victory Garden Program and of service thus rendered the Nation."

Walter L. Sturtevant, chemical engineer at the Manhattan plant, was honored on his retirement at a dinner December 17 at Robin Hood Inn, Clifton, N. J. More than 100 friends and coworkers attended. Mr. Sturtevant had been chemical engineer since 1931 and had represented Manhattan on various government and scientific committees. Before 1931 he was chief chemist and assistant superintendent in charge of laboratory, mill and calender departments. He was appointed to that post in 1917, five years after he had joined the firm as a chemist.

Before joining Manhattan, Mr. Sturtevant had been a chemist at the Rutherford Rubber Co. and previously a chemist at the General Electric plant in West Lynn.

Mr. Sturtevant is a graduate of the University of Maine and is a native of Bangor. He is a member of the American Chemical Society and in 1929 was chairman of the New York Rubber Group. He is also a member of the American Society for Testing Materials and has been chairman of various committees. He has authored articles in various techhnical papers on testing mechanical rubber goods and fabrics. Since 1917 he has been Manhattan's representative for the Rubber Manufacturers' Asssociation on the technical committee of mechanical rubber gods. He was vice chairman of the group three terms. During the war he was a member of the Navy's rubber reserve committee and was awarded a naval ordnance emblem for distinguished service.

War Assets Administration, Washington, D. C., among the surplus products offered for sale last month included the following: two million tire repair patches which cost $2,750,000; new and used truck tires costing $1,300,000; two million gallons of xylidine; telephone and telegraph equipment including 45,564 feet of telephone cable, 9,768 feet of cordage, 25,000 cords, 462 telephones; three million military and naval gas masks; 4,000 barrage balloons.

Carlisle Tire & Rubber Co., Carlisle, Pa., has elected to the board Fleet Admiral William F. Halsey, Jr., who has been relieved of active participation in naval affairs at his own request after 46 years of service.

World's Industrial Fair

Rubber and sporting goods exhibits will be featured in the World's Industrial Fair, to open in June along the famous boardwalk in Atlantic City, N. J., it was recently announced by William G. Rolley, Fair president. The principal exhibit building of the Fair will be the Million Dollar Pier which extends out over the Atlantic Ocean for more than a third of a mile. The Fair, a permanent one, will establish Atlantic City as the preview center for innovations occurring in the industrial field.

It will be the first World's Fair since the New York one of 1939-40, whose famous symbols of the trylon and perisphere will be replaced by the smokestack and the gear.

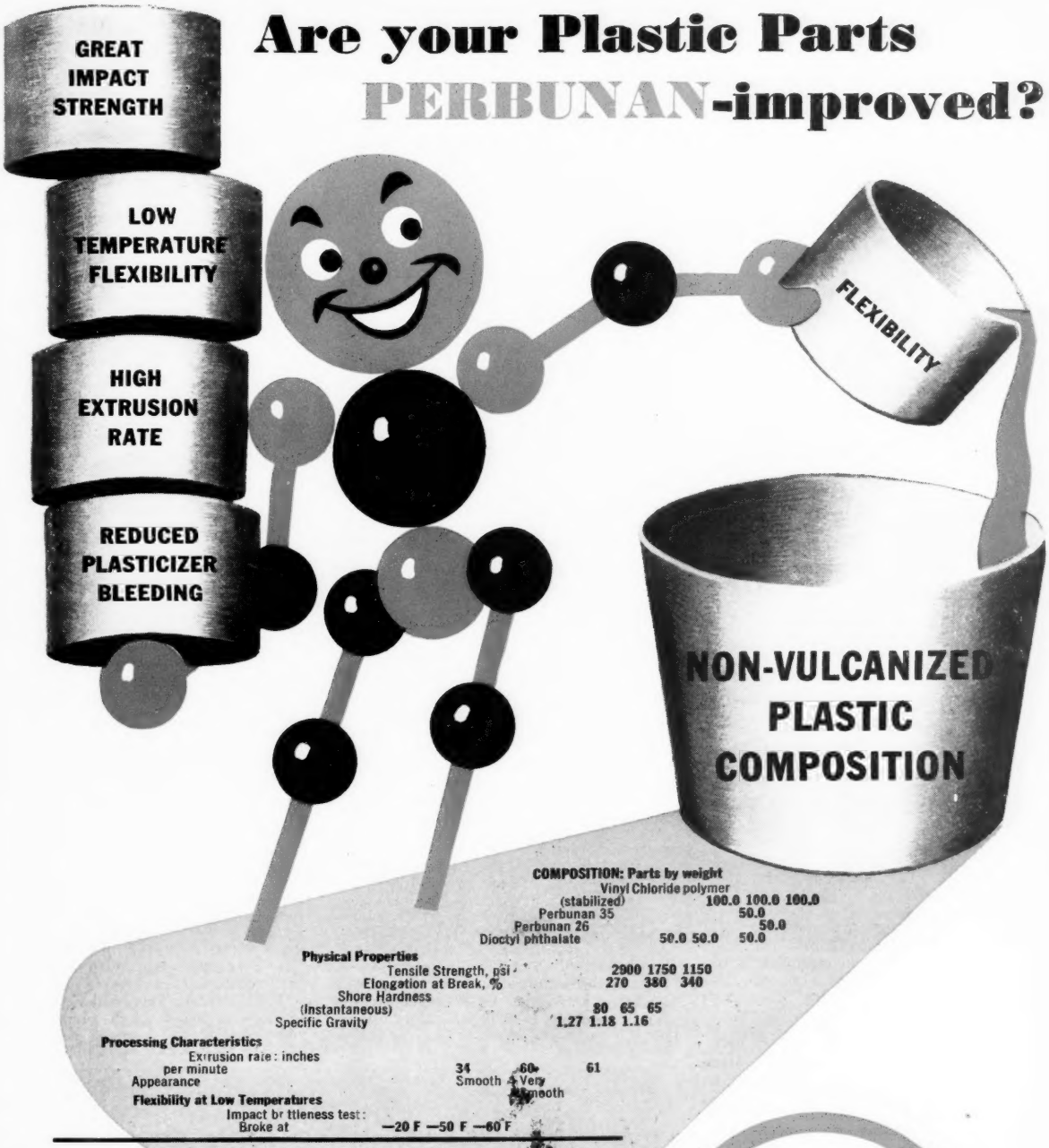
Koppers Co., Inc., Pittsburgh, Pa., has authorized its engineering and construction division to design and build at Kobuta, Pa., a polystyrene plant with an annual capacity of 15 million pounds, it was recently announced by Dan M. Rugg, company vice president and general manager of the chemical division. The plant will be adjacent to the styrene and phthalic anhydride plants now owned and operated by Koppers at Kobuta. Koppers now is producing polystyrene commercially on a small scale at the Kobuta plant and expects to make first shipments soon. Small commercial production from these facilities will continue until the large plant is in operation. The company makes styrene at Kobuta from benzene, and the manufacture of polystyrene is a further processing of styrene. Pilot plants have been operated by company research scientists at Mellon Institute, and the processes to be used in the large polystyrene plant were developed through this research. It will take about a year to build the new plant and get it into operation, Mr. Rugg stated.

Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., has announced that a new sales unit, the rubber chemicals department, has been created to handle the sale of rubber chemicals to the rubber industry. The rubber chemicals department of American Cyanamid has been merged with the new Calco sales unit. This change places at the disposal of the rubber industry the specialized experience of the Calco organization. Bancroft W. Henderson, manager of the rubber chemicals department, American Cyanamid Co., has been named to head the new department.

Heyden Chemical Corp., 393 Seventh Ave., New York, N. Y., is adding a $450,000 fine chemicals building to its plant at Fords, N. J. Of brick, steel, and concrete, the new structure will provide an additional 5,000 square feet of floor space to be used in the production of organic chemicals. The building will also be two storeis high except for the tower portion, which will rise five stories to accommodate twin fractionating columns.

Heyden also has moved its Chicago, Ill., offices to more spacious quarters at 20 N. Wacker Dr. F. A. Degener is in charge of the office, and J. E. O'Donnell, Wm. C. Ellis, and G. S. Kahle are representatives.

Are your Plastic Parts PERBUNAN-improved?



COMPOSITION: Parts by weight			
Vinyl Chloride polymer (stabilized)	100.0	100.0	100.0
Perbunan 35		50.0	
Perbunan 26			50.0
Dioctyl phthalate	50.0	50.0	50.0
Physical Properties			
Tensile Strength, psi	2900	1750	1150
Elongation at Break, %	270	380	340
Shore Hardness (Instantaneous)	80	65	65
Specific Gravity	1.27	1.18	1.16
Processing Characteristics			
Extrusion rate: inches per minute	34	60+	61
Appearance	Smooth	Very Smooth	
Flexibility at Low Temperatures			
Impact brittleness test: Broke at	−20 F	−50 F	−60 F

The data illustrate how Perbunan 26 or 35, blended with a vinyl chloride polymer, provides *increased flexibility, great impact strength, low temperature flexibility, high extrusion rate* and *reduced bleeding of the plasticizer.* Perbunan—remarkable by itself in many automotive and aircraft parts—now greatly improves non-vulcanized plastic compositions. *Specify Perbunan for your rubber and plastic parts!*

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THE SYNTHETIC RUBBER THAT RESISTS OIL, COLD, HEAT AND TIME

MIDWEST

Erecting Plant in Brazil

To conserve domestic supplies of castor oil, linseed oil, oiticia oil and glycerine—all of which are still in fair supply in Brazil—and at the same time afford better service to Brazilian customers, Reichhold Chemicals, Inc., Detroit, Mich., is now constructing a resin manufacturing plant on three acres of ground recently acquired in the northeast section of Rio de Janeiro.

Reichhold Chimica Industrial (do Brasil) S. A., the Brazilian company, will be headed by Mario de Oliveira Brandao and H. Levy, officers of James Magnus, Ltda., Reichhold's present Brazilian agents. Actual management of the plant will be in the hands of Messrs. Brandao and Levy; while the production will be supervised by an RCI-trained technician from the United States.

Manufacturing equipment for the Brazilian plant is being shipped to Rio from this country and will be installed under the direction of one of the engineers from RCI's domestic plants. As soon as resin manufacturing operations in Rio are in full swing, a technical service laboratory will also be installed for the benefit of Brazilian customers.

Production of the Rio plant is currently estimated at 1½ million pounds of resin a year, but its construction has been arranged to permit the installation of additional kettles, should an increased output be called for.

James Magnus, Ltda., will act as selling agent for the new company and will continue as agent for RCI colors, together with any special resins which it may still prove necessary to import after the Brazilian plant starts functioning.

Monsanto Operations

Monsanto Chemical Co., St. Louis 4, Mo., announced on December 4 the completion of final installations for phosphoric acid and sodium phosphate manufacture at its plant in Trenton, Mich. The shift of phosphoric acid and sodium phosphate operations from Monsanto's Anniston, Ala., plant began with the opening of the Trenton plant in 1942, but was delayed because of wartime restrictions. Sodium phosphates now produced at Trenton include monosodium phosphate, disodium phosphate, trisodium phosphate, tetrasodium pyrophosphate, sodium acid pyrophosphate, and polyphosphates. The production of tetrasodium pyrophosphate, formerly carried on at the company's Monsanto, Ill., plant, also has been shifted to Trenton.

Monsanto has advanced John J. Healy, Jr., director of development for its Merrimac division at Everett, Mass., to the assistant general managership of the division, according to General Manager Daniel S. Dinsmoor. Mr. Healy, a native of Boston and graduate of Harvard University, has been with Merrimac since 1921. In taking over his new assignment he will continue to carry the responsibility for coordination of the division's current expansion program. Mr. Healy is a member of the admissions committee of the American Institute of Chemical Engineers, a former chairman of the Institute's Boston Section, and a director and a national councilor of the Northeastern Section of the American Chemical Society.

L. F. Loutrel succeeds Mr. Healy as director of the development department.

The plastics division at Springfield, Mass., is erecting a new pilot-plant for plastics research at an estimated cost of $175,000 and to be completed by early summer. The pilot plant, designed for experimenting with production methods for new products, will be a three-story brick, steel, and concrete building with a floor size of 60 by 120 feet. The new unit will more than double the facilities for production research and development work of the company's research department. Company officials also announced that the color laboratory will be tripled in size to handle the increased load brought about by the expanded production of all types of plastic materials. At the same time new injection molding equipment will be installed in the color laboratory to facilitate sample molding runs.

Monsanto's plastics division opened a Cincinnati sales office on January 1, with Edward T. McBride in charge as branch manager. Mr. McBride entered Monsanto's service last April following his discharge from the Army at the rank of lieutenant colonel. During the early part of the war he was in charge of the redesign of Ordnance materiel to permit use of plastics. He holds technical degrees from Newark Tech and Seton Hall College.

The office will be staffed by Joseph T. Demers and William S. Blanchard. Its sales territory will embrace parts of Ohio, Indiana, Kentucky, Tennessee, and Pennsylvania, and all of West Virginia.

Johan Bjorksten, owner of Bjorksten Laboratories, 185 N. Wabash Ave., Chicago 1, Ill., has formed a corporation under the name of Bjorksten Research Laboratories, which will continue and expand the business of Bjorksten Laboratories. Officers of the corporation are: Dr. Bjorksten, president and treasurer; Stuart O. Fiedler, vice president; A. Charles Lawrence, secretary. The officers also constitute the board of directors. As president of the corporation, Dr. Bjorksten will continue directing the affairs of the organization. Mr. Fiedler will continue his duties as manager of the South Chicago branch laboratory. During 1946 approximately 80% of the business of Bjorksten Laboratories was research assignments for corporations on a yearly contract basis; 15% was on chemical market surveys, and 5% on miscellaneous assignments.

Building Plant in Utah

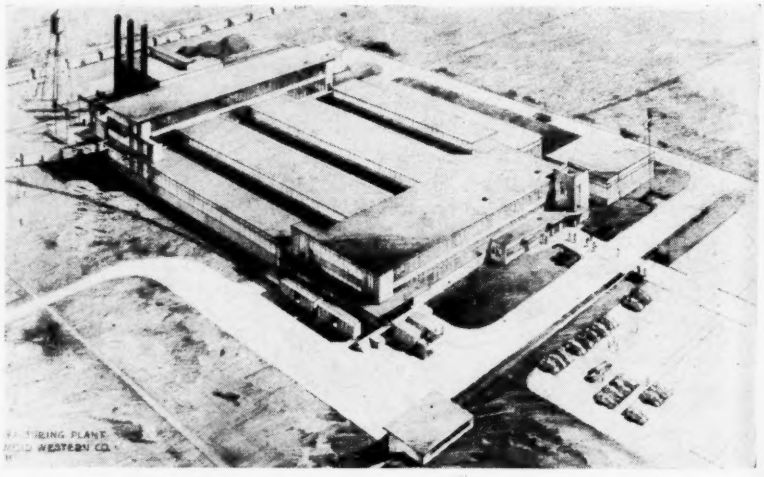
To supply its West Coast and Northwest business Thermoid Co., Trenton, N. J., is erecting a new manufacturing plant at Nephi, Utah, to be known as Thermoid Western Co. It is hoped that operations will begin this summer.

The new plant will comprise 200,000 square feet of floor space, with the main manufacturing building totaling 165,000 square feet. The plant has been designed for maximum production efficiency. Raw materials are sent to the top floor of the plant at one end and through successive stages move downward through preparatory areas, to ground level, then progressively through manufacturing areas to the other end of the building where finished products are ready for shipping. Features of the plant include three railroad sidings, two elevators, a sprinkler system, a 125,000-gallon water storage tank, two Babcock & Wilcox 750 h.p. boilers, and hydraulic steam and air pumps. The plant will also be equipped with a modern cafeteria and modern dressing and washrooms for employes. There will be parking facilities for employes' cars, and opposite the plant a complete service station for overhauling autos and trucks.

For the most part, manufacturing will be directed toward production of rubber products such as V-belts, fractional horsepower belts, conveyer and transmission belting of all types, oil field products, such wrapped hose items as rotary hose, stuffing box rings, and suction and air and vacuum hose, and molded hose products including air, water, and steam hose, wire hydraulic molded hose, and woven radiator hose. Thermoid Western also expects to add a special building for the production of certain types of brake lining. It is estimated that the plant will be able to produce 12,000 fan belts and about 40,000 feet of hose a day.

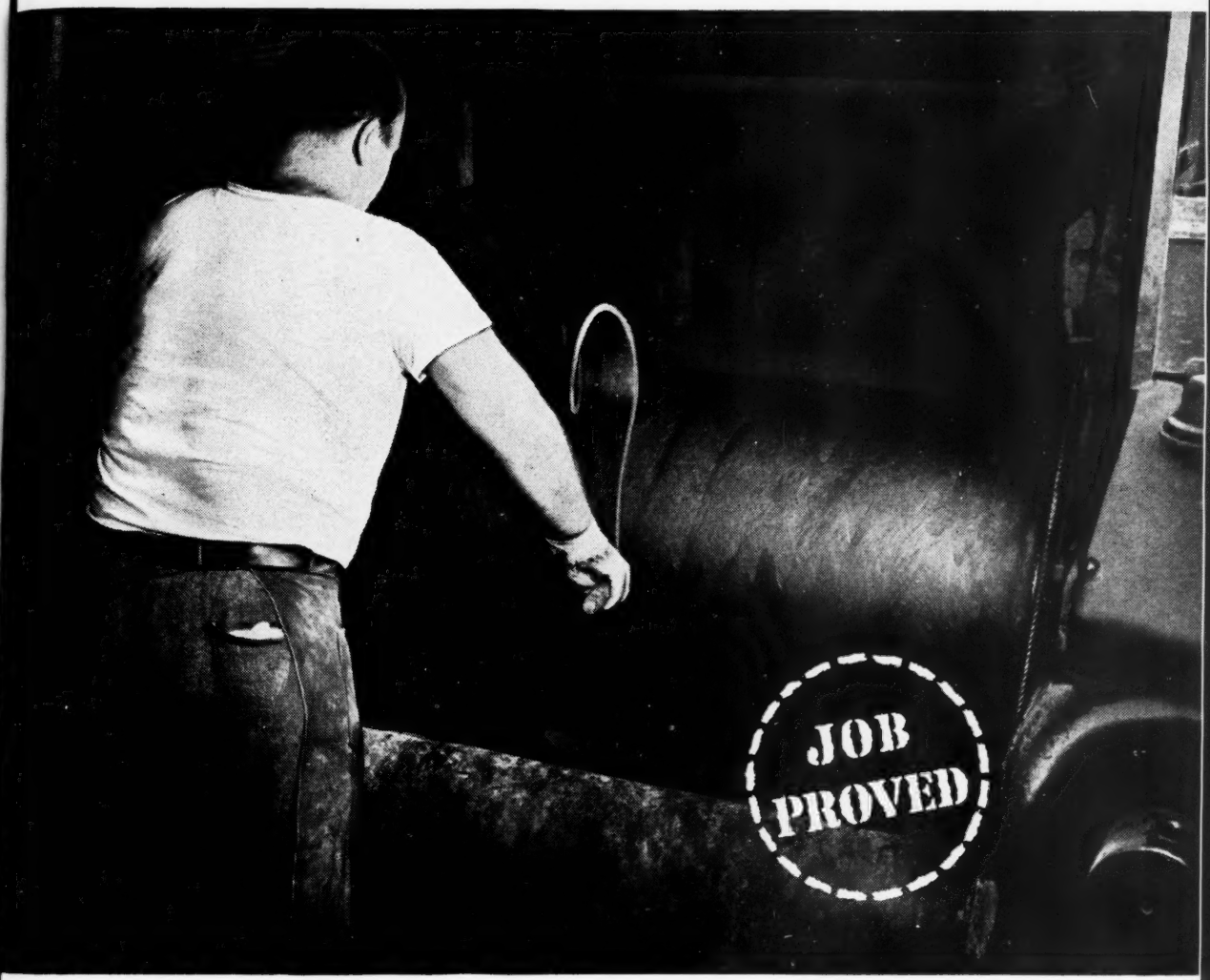
It is further planned to build up the total number of workers to 500 or 600.

W. D. Pardoe, Thermoid vice president, has been in charge of the construction of the Utah plant.



Architect's Drawing of Thermoid Western Co. Plant, Nephi, Utah

Easy to Handle!



SUN RUBBER-PROCESSING AID...

Gives Desired Softness, Speeds Up Milling by 15%

A manufacturer of hose, gasketing, and other mechanical goods was using cottonseed and paraffin spindle oils as softening agents, but had considerable difficulty in getting the desired product softness.

A Sun Engineer recommended a specially refined Sun rubber-processing aid, a carefully selected group of hydrocarbons that have a natural affinity for rubber.

The desired softness of 20 on the Shor Durometer was readily obtained when the plant switched to this Sun "Job-Proved" material. The rubber was much easier to handle, and milling time was reduced by 15%, with savings in labor and power.

Sun rubber-processing aids are highly compatible with natural and synthetic rubbers. They eliminate blooming, cracking, hardening or bleeding. For modern "Job-Proved" rubber-processing aids, call your nearest Sun office.

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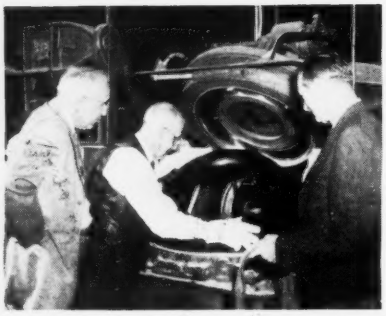


Chester A. Capron, Jr.

(Left to Right) Charles Wetsel, Wm. Lerch, and Howard Cope Looking Over the First Inner Tube Recently Made by Cascade Rubber, Inc.

Cascade Now Makes Inner Tubes

Cascade Rubber, Inc., Cuyahoga Falls, is now manufacturing a line of passenger and truck tire tubes. For the past 10 years a producer of camelback and tire repair materials, the firm is extending its operations to include the Cascade "Blue Label" tube which will be available in all passenger-car tire sizes and most of the popular truck tire sizes.

The company's plant in Cuyahoga Falls is equipped to produce 1,000 tubes a day. Installation of the latest McNeil curing presses fitted with chrome plated molds has just been completed.

The new tube will be sold through established dealers who for a decade have marketed the company's camelback and tire repair materials. These dealers are in an area which extends from the East Coast to the Mississippi River.

In manufacturing auto and truck tire tubes, the firm is entering a field in which its executives are already well equipped by experience, a company spokesman pointed out. William G. Lerch, Howard J. Cope, and Charles R. Wetsel, Cascade's officers, have a combined background of more than 100 years in the rubber business.

Mr. Lerch became associated with Miller Rubber Co. in 1907, and was made assistant superintendent in 1910. He later was with India Tire & Rubber and with Master Tire & Rubber, leaving the latter firm in 1936 to help found Cascade, of which he is president. His 40 years in the industry have produced a number of improvements in development and production methods, including several patents. One of them is the double-cord breaker for truck tires.

Mr. Cope has worked with rubber since 1911 when he joined Firestone. He was subsequently associated with General Tire & Rubber, Vulcanizers' Equipment Co. and Dayton Rubber Mfg. Co. With Mr. Lerch he organized Cascade 10 years ago.

In 1938, Mr. Wetsel became an officer of the company. He had been previously with Miller Rubber, which he joined in 1911 and served as western division sales manager. Later he went with Master Tire and from there to Cascade.

Independently owned and operated, Cascade Rubber, Inc., has had a rapid growth in 10 years. The firm will continue to manufacture its camelback and tire repair materials lines.

The General Tire & Rubber Co., Akron, through H. L. Creecy, southern division manager, has announced the appointment of Ronald H. Herd as territory salesman in northern and central Georgia. Mr. Herd, 36, is married and a graduate of Georgia Tech. He is a native of Atlanta and will continue to reside there. Before becoming associated with General Tire, Mr. Herd had been district manager for The Chevrolet motor Co., for whom he had worked 15 years.

Pharis Tire & Rubber Co., Newark, reports that car owners who have cussed out synthetic inner tubes because they often buckled in sub-zero weather and left them flat can now credit science with **another big assist,** as the new red du Pont neoprene tubes have just come through a series of unique tests which prove that they can shake off the effects of extremes in temperature. The dynamic cold tests were conducted by Ralph M. Reel, Pharis vice president in charge of research and development. Both neoprene and conventional synthetic tubes were subjected to the following tests: A tube was inserted in a Pharis tire mounted on a 1940 model Ford wheel. Soapstone was used as a lubricant. The entire wheel assembly was immersed into a bath of alcohol and dry ice and kept at a temperature of —40° F. for one hour. Upon removal from the bath, the assembly was applied to a car as quickly as possible, driven four miles at 35 m. p. h., and then removed and examined. This cycle of immersion and driving was repeated 10 times. The neoprene tube, stated Mr. Reel, proved definitely resistant to a creeping process which, in other synthetics, is accelerated by cold weather. Most synthetic rubbers at sub-zero temperatures tend to flow toward the crown of the tire, forming a long circumferential buckle or fold. This creep also causes a thinning of the sidewall in proportion to the amount of buckle and the length of time the tube is subjected to cold. While neoprene does flow, it soon returns to its original form without any serious permanent damage to the tube. Other rubber substitutes retain the fold and thin spot, which quickly lead to tube failure.

Goodyear Expanding Operations

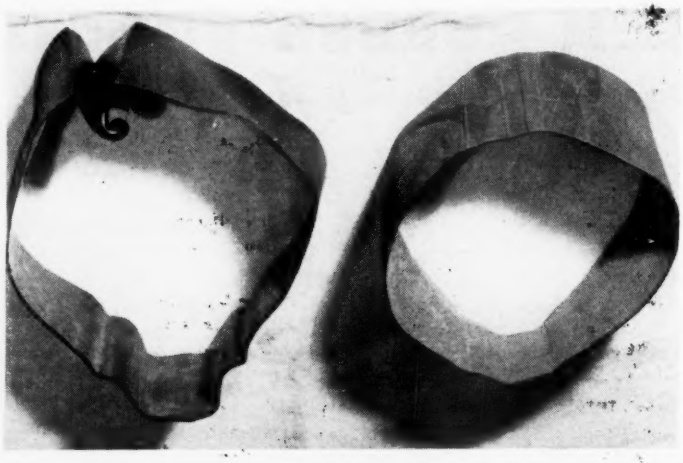
Production is under way at Goodyear Tire & Rubber Co.'s new factory near Havana, Cuba, it was announced last month by George K. Hinshaw, vice president and production manager of the company's foreign operations. Built in the middle of a 14-acre orange grove, the new plant is producing popular-size tires and tubes, repair materials, and rubber heels for the Cuban market.

Goodyear personnel at the new plant is headed by Richard P. Morgan, vice president and general manager; Marvin A. Ryan, vice president in charge of production; and Eugene Riveroll, treasurer. Mr. Morgan joined the Goodyear Export Co. in 1926, and most of his service has been in the foreign field—Puerto Rico, the West Indies and South America. In 1938 he was made manager of the Goodyear plant in Venezuela. Before going to Cuba, Mr. Ryan had been division superintendent of the company's plant in Brazil since 1942. He joined Goodyear in 1933 at Los Angeles, Calif. Mr. Riveroll, with Goodyear since 1943, was previously office manager of the company's factory in Mexico.

A $1,850,000 modernization and expansion program, designed to assure continuous capacity operation of all tire production machinery is under way at Goodyear's Jackson, Mich., plant, according to plant manager E. T. Ruffner. Principal phase of the overall improvement plan is an addition to the plant's milling and compounding division to provide a steady flow of rubber stock for tire and tube building. The program, scheduled for completion this spring, culminates a highly systematized reconversion plan that began in 1944 with installation of facilities to increase tire and tube production 28% over the prewar level.

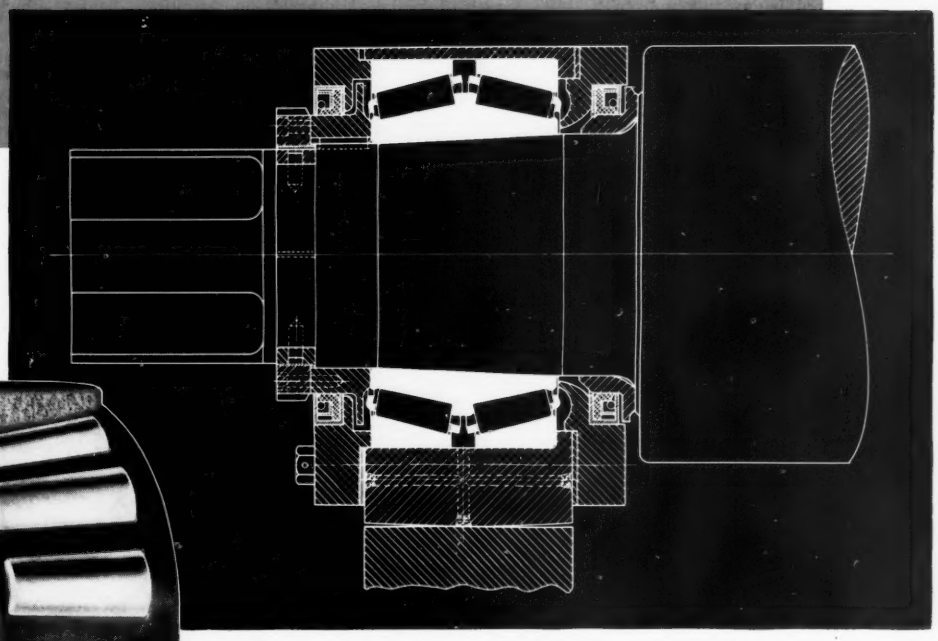
In announcing the engineering improvements, Mr. Ruffner stated, "Since last September when the Jackson plant attained production capacity, it has been necessary to operate our milling and compounding machinery on a seven-day-week basis. Addition of new equipment and rearrangement of certain operations will further modernize the plant and enable us to maintain an adequate supply of stock for tire and tube building."

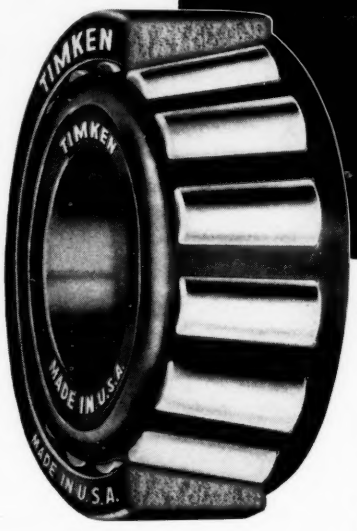
Predicting peak production of passen-



Left, Cross-Section from Typical Synthetic Inner Tube Showing Buckle along Crown after 10 Cycles of Immersion at -40° F. for One Hour and 10 Four-Mile Trips at 35 m.p.h. This Buckling Caused Many Tubes to Crack Open before Completion of 10 Trips. At Right, a Neoprene Tube after the Same Tests

YOU *Specify* THE TOLERANCE—





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It makes possible accurate and constant gap setting between rolls with resulting close control of product thickness; minimum operating and maintenance costs; and extended calender life.

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TAPERED ROLLER BEARINGS

48 YEARS OF ENGINEERING AND METALLURGICAL DEVELOPMENT

ger tires for the first six months of 1947, the plant manager added, "There have been numerous occasions this year when tire manufacture was on the brink of stoppage due to insufficient supplies of raw materials. The situation still is touch-and-go on as many as 13 items among those required in building a tire."

Expansion of production facilities has brought the output of Goodyear rubber and Neolite soles and heels up to 400,000 pairs daily, Harry L. Post, manager of the company's shoe products division, announced recently. The doubling of manufacturing capacity at Goodyear's Gadsden, Ala., plant and new installations at St. Marys, O., and Los Angeles, Calif., have added materially to the volume of shoe products put out by the company's original sole and heel plant at Windsor, Vt.

Industrial rubber hose-making capacity at Goodyear is now virtually double that of the last prewar year, according to W. C. Winings, sales manager of the mechanical goods division. Increased postwar demand for hose has exceeded peak production, and plant expansion will continue into 1947 as the company receives additional equipment ordered months ago. A heavy volume of special-service "hand built" hose has developed with commercial application of new products engineered under wartime stress. Current production is concentrated on air, steam, water, vacuum, paint spray, acetylene welding, and numerous types of petroleum hose. Mr. Winings stated, a peacetime changeover from military output which included marine hose up to a foot in diameter, and special bullet-sealing hose for aircraft.

Other Goodyear Announcements

Two members of the crude rubber purchasing division have received overseas assignments to Singapore, headquarters for Goodyear's rubber purchasing staff in the Far East. Noel Cook goes there as rubber buyer, and Louis F. Griesenbeck has been named manager of the company's Singapore warehouse.

Joining Goodyear in 1933, Mr. Cook's first overseas assignment was in 1937 when he went to Singapore as warehouse manager. A year later he became assistant purchasing agent in Ceylon, India, and in 1942 he was recalled to Akron to serve in Goodyear Aircraft Corp.'s purchasing division. He returned to the crude rubber staff a year ago.

Mr. Griesenbeck has been with Goodyear since 1941, starting as a rubber inspector in New York. He held a similar post in Akron during the war, returning to the New York staff early this year.

Samuel J. Mabry has been appointed office manager of Goodyear's mechanical goods division, Los Angeles, Calif., succeeding L. A. Strauss, who resigned to enter other business. A native of Mt. Vernon, Ill., Mr. Mabry joined Goodyear in 1935, starting at the Los Angeles factory. After two years on the producttion training squardon he held several posts in the factory's production control department before transferring recently to the mechanical goods sales division.

P. W. Beggs, superintendent of Goodyear's textile mill in Sao Paulo, Brazil, recently arrived in the United States on home leave after six years overseas. A native of Kansas, Mr. Beggs has been associated with Goodyear since 1920, starting as an inspector for the Southwestern Cotton Co., Phoenix, Ariz. Later he became a cotton buyer for Goodyear and before going to Brazil had been superintendent of Goodyear's tire fabric mill in Los Angeles for 11 years.

A new method of packaging fresh fruit that will revolutionize its shipping and handling has been perfected by Spencer A. Larsen, director of the air cargo research of Wayne University, in conjunction with the Goodyear research laboratory. Named the "hammock pack" by Dr. Larsen, the new method firmly suspends each individual fruit in Pliofilm, preventing sway or any contact which might cause bruising, a major factor in spoilage in the present method of shipping perishables. While seeming to be more difficult and expensive a packing method, the new technique is actually stated to be simpler, quicker, and less costly. The foundation of the "hammock pack" is formed of two sheets of cardboard, in each of which a series of circular holes has been cut, each hole slightly larger than the diameter of the fruit to be packed. Each sheet is then covered with a film of pliofilm. One sheet is then warmed slightly, and the pieces of fruit are placed on the cardboard, one piece over each hole. The warm Pliofilm stretches, permitting the fruit to sink in a sort of cradle. The other Pliofilm-cardboard sheet is then warmed and pressed down over the fruit. Its Pliofilm sheathing likewise stretches around the fruit, and the two Pliofilm sheets stick together to form a heat seal. The assembly with its suspended fruit is then packed into cartons equipped with cardboard partitions, as in egg crates, which protect the fruit from any contact. Advantages of the new packing method are stated to be: preservation of the fresh flavor of the fruit; protection against any contamination; protection against bruising; and the transparent Pliofilm allows better display by the dealer and examination by the consumer.

Something new in the popular-priced hose field has been announced by Goodyear's mechanical goods division. Designated as the Black Wing cord line of water and air hose, it features a body structure based on a new manufacturing principle, according to R. W. Sanborn, company hose sales manager. Horizontal braiding, an exclusive method of bonding cover, carcass, and tube together, gives the new hose rope-like flexibility and yet retains maximum ruggedness. Designed to stand up under extreme service conditions, the water hose is expected to prove particularly adaptable for construction operations requiring a kinkless, easily handled conduit. The hose is built in ¾- to 2½-inch sizes. Also highly flexible, Black Wing air hose is manufactured in two types: two-braid standard for penumatic tool service; and three-braid heavy-duty for air drill usage. Sizes range from ⅜-inch to 1½ inches. Both products utilize the wartime-developed cabled cotton body for greater carcass strength, and a sturdy, seamless tube unaffected by lubricants which often cause swelling and flaking.

Speedier and more economical rice harvesting is foreseen in Goodyear's development and production of a tire designed specifically for soft, loamy soils. Principal feature of the tire, according to R. W. Sohl, manager of tractor tire design, is its deep tread lug, which closely resembles the company's self-cleaning, open-center Sure Grip tractor tire design. Advantages of rubber-tired equipment in the rice fields have been vividly demonstrated. Tests show that a rubber-tired tractor will travel a distance of 1,320 feet beyond the steel-wheeled tractor in the same time, representing an increase of 15.7% work done, or one hour and 22 minutes saved per 10-hour day. Tests made on fuel consumption showed the rubber-tired tractor to travel farther on the same amount of fuel with the same load as the steel-wheeled tractor.

Goodyear has announced that it again is in production of LifeGuard safety tubes for both passenger buses and trucks, and of puncture-sealing tubes in both truck and passenger-car sizes. For almost five years during the war period, production of these products was greatly curtailed or suspended, except for high priority military purposes. According to Frank Griesinger, manager of tube sales, LifeGuards eliminate the hazard of blow-outs from high-speed bus and truck operations, protecting against damage to equipment and injury to personnel. The tubes consist literally of a two-ply cord tire built inside a conventional appearing, high-quality inner tube. Regarding the Puncture Seal tubes, Mr. Griesinger stated that they were an outgrowth of the company's experience in making bullet sealing tubes for military use. They are of the plastic sealing type and are built to exceed government specifications for this type of tube. Puncture Seal tubes are recommended for service where punctures are frequent and cause road delays, but under conditions where continuous high speed is not a factor in operations.

America's 17-billion dollar highway construction and maintenance program will use the most modern and efficient pneumatic tires ever produced, according to J. E. Mayl, Goodyear vice president. Keeping pace with manufacturers of heavy equipment, the tire industry as a whole has made drastic and dramatic changes during the past ten years, Mr. Mayl said. An example is Goodyear's contemplated production of earthmover tires of 30.00-33 size. This 30-ply rating tire will stand 95 inches high and weigh 2,085 pounds. Its cross-sectional width will measure more than 33 inches. The largest earthmover tire heretofore manufactured was the 27.00-33 size. Production of earthmover tires represents an achievement in engineering and designing of special products for specific needs. Prime qualifications of earthmover tires, Mr. Mayl added, are their ability to carry maximum loads at maximum flotation, to resist snagging, bruising, and cutting, to provide strength for carrying heavy loads, and to supply traction for all types of surfaces.

Wise Allied Products, Inc., Ada, according to President R. M. Wise, is erecting a single-floor, concrete block building with initial floor space of 8,400 square feet, which will house present equipment as well as the additional equipment that the firm is going to install for the production of molded rubber articles. At present Wise Allied is producing molded bathing caps and miscellaneous rubber items.

The Standard Chemical Co., Akron, has announced the change of its name to the Harwick Standard Chemical Co. Under the new name the products, policies, and management of the company remain unchanged. C. J. Harwick is general manager.

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Firestone Developments

Firestone Tire & Rubber Co., Akron, had a premiere showing of its new technicolor picture of the 1946 Indianapolis automobile race featuring comments by Wilbur Shaw and other noted racing drivers, and a new technicolor film made by Walt Disney on the building of a tire, in New York, N. Y., at the Ritz-Carlton Hotel on November 20 and in Detroit, Mich., on November 29. The Detroit showing was before the local section of the Society of Automotive Engineers, and Mr. Shaw was present in person at this meeting. Both films are very well done, and both should be very valuable aids to the Firestone company in particular and the rubber industry in general in explaining to the public the high quality and excellent performance of present-day tires made of synthetic rubber or blends of synthetic and natural rubber.

A war-born solution to the problem of keeping bullet-riddled tires on rims has been converted to peacetime use by Firestone, with a resultant increase of up to 40% in original tread mileage by use of a new, wider rim. Company rim engineers, watching the record of the military rim, incorporated even newer features into their designs which are now available to truck, bus, and trailer operators. Research has shown that in order to obtain the best tire mileage, the rim should be 70% as wide as the cross-section of the tire it carries. Backbone of any tire, especially the big truck and bus tires, is the bead. Heretofore only one side of the bead, the rubber encased steel that rests on the rim, had been anchored. The other side of the rim was not raised, resulting in rock and sway of the tire which caused bead chafing, a contributing factor to blowouts and sidewall failures. Firestone solved the problem by raising the other side of the rim, making a full five-degree taper possible on both sides. These tapers make it possible to lock the tire beads to the rim, virtually ending wobble and greatly reducing rim rust and corrosion. Tests have indicated that up to 30% of the increased tread mileage is due to the wide rim; while an additional 10% of wear is added by the elimination of the tire wobble.

An all-plastic clothesline that will defy sun and rain and will not rust, rot, sag, or stretch, is being introduced by Firestone through its retail stores. Sixteen strands of the company's Velon plastic are braided together to give the line exceptional strength. Clothespins clinch firmly to the braided line and will not slip off when clothes are whipped about in strong winds. The line is also decorative, using black and white plastic strands.

J. W. Liska, a member of the Firestone research staff for the past 14 years, has been appointed an assistant director of the Firestone chemical and physical research laboratories. Dr. Liska replaces J. H. Dillon, who recently became director of the Textile Research Foundation and Textile Institute at Princeton, N. J.

R. F. Dunbrook, until recently chief of the Polymer Research Branch of the Office of Rubber Reserve, has now resumed his prewar responsibilities at the Firestone research laboratories, where he and O. D. Cole are assistant directors of research in their respective fields.

The engagement was recently announced of Miss Martha Parke Firestone, daughter of Harvey S. Firestone, Jr., president of the Firestone company, and William Clay Ford, grandson of Henry Ford. The wedding is scheduled for June 21.

Diagram Showing How New Firestone Rim Holds Both Tire Beads Firmly in Place

Elizabeth Firestone, another daughter of Mr. and Mrs. Firestone, Jr., played "Fantasy," consisting of three of her original compositions, when she appeared as guest pianist on the "Voice of Firestone" radio program, November 18. She was accompanied by the Firestone symphonic orchestra under the direction of Howard Barlow. Miss Firestone has been steadily gaining recognition as a musician and composer, several of her compositions having been featured over national networks the past two years.

Denman Tire & Rubber Co., Warren, at its recent directors' meeting elected the former heavyweight champion, Gene Tunney, chairman of the board to succeed Russell McCandless, who, however, remains director. Other company officers continue, as follows: president, Wilson B. McCandless; vice president and general manager, H. F. Webster; vice president, E. L. Antonen; secretary-treasurer, J. D. Simpson. The election of Mr. Tunney was in recognition of the outstanding help he has been to the company as a director for the past year.

Hycar American Rubber will henceforth designate the nitrile-type rubber produced by the B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, according to President W. S. Richardson. Rubber manufacturers have long felt that the word "synthetic" carries the implication that rubber so named is inferior to natural rubber. Mr. Richardson also stated that this change is in accordance with the current trend in the rubber and chemical industries to end usage of the word synthetic in reference to man-made materials which are in no way "imitations or substitutes," and which are for many purposes superior to natural rubber products.

The Timken Roller Bearing Co., Canton 6, has announced the retirement of Purchasing Agent Albert C. Walsh after 26 years with the company. Mr. Walsh came to Timken when it purchased the Gilliam Mfg. Co., by whom he had then been employed.

Seiberling Rubber Co., Akron, has made Arthur A. Leedy director of engineering, and J. E. Kallgren, formerly a project engineer for United States Rubber Co., New York, N. Y., has been named chief engineer of the Seiberling Barberton, O., plant, to fill the vacancy created by Mr. Leedy's promotion. Mr. Kallgren was a staff engineer for the Firestone Tire & Rubber Co. from 1933 to 1942, when he joined U. S. Rubber.

Mr. Leedy's position, a new one in the Seiberling organization, places him in charge of engineering policy at both the Barberton plant and other existing or prospective domestic plants. He is expected to be of more assistance to Seiberling's Canadian plant and to companies in France and England with which Seiberling has technical associations.

Goodrich Appointments

Warren H. Hackett and E. A. Doerschuk have been made assistant treasurers of The B. F. Goodrich Co., Akron. Mr. Hackett, formerly manager of the insurance and real estate department, began his rubber career in 1913 and had been assistant secretary and treasurer of the Miller Rubber Co. when it was acquired by Goodrich in 1930. Mr. Doerschuk, formerly general credit manager of the company, came to Goodrich after his graduation from Ohio State University in 1916 and has been a member of the credit department of the company's treasury division ever since. He will continue his responsibility for credits.

The crude rubber purchasing office of the Goodrich company is again being opened in Singapore, Straits Settlement, with George M. Naylor as managing director, it was announced by E. A. Stevens, manager of crude rubber purchasing. The office closed with the Japanese occupation. Mr. Naylor is widely known in the crude rubber trade, where he has spent practically all his career. He was on the crude rubber purchasing staff of the company from 1929 to 1942, when he retired; much of that period was spent in Malaya.

William E. McCormick has been made chief of the industrial hygiene department, duties of which are to study operating conditions to see if they are hazardous, and if so, eliminate the hazards. Mr. McCormick is now coordinating various toxicology studies made for the company in laboratories throughout the country, to determine what materials can be best used in certain products without toxic results to employes engaged in manufacture or to the consumer. Mr. McCormick comes to Goodrich from the state health department of Georgia, where he had been in industrial hygiene work.

Charles H. Caldwell has been appointed manager of advertising and sales promotion for the recently created shoe products sales division according to Frank T. Tucker, director of advertising. Mr. Caldwell has been with Goodrich since 1944, in the sales promotion department. He is a graduate of the Robert Morris School of Business and took special studies at the Retail Research Bureau of the University of Pittsburgh.

Edward J. Lewis has been appointed assistant to W. E. Ireland, manager of passenger-car tire sales for Goodrich. Mr. Lewis, with the company 17 years, has been recently handling sales promotion on passenger-car tires, accessories and repair materials, batteries, and spark plugs. A graduate of the University of Illinois, he started his career with the company in sales promotion in the Chicago district and later handled a variety of sales assignments.

A new tire for heavy-duty commercial trucks using rayon cord throughout was announced by J. E. Powers, manager of the Goodrich truck and bus tire department. The tire is manufactured in sizes ranging from 6.00-16 through 7.50-16, with which practically all the light trucks in this classification are equipped. The rayon cord used in the tire is weftless; so there are no cross-threads to produce tension. Each cord is straight and uniform in length and tension.

Goodrich has purchased the Tulsa Rubber Products Co., 716 S. Boston, Tulsa, Okla., according to Robert A. Blacklev, head of the Tulsa retail store which deals in sporting goods, tires, and rubber products.

RUBBER CHEMICALS DEPARTMENT

now a unit of

CALCO CHEMICAL DIVISION
AMERICAN CYANAMID COMPANY

Effective January 1, 1947, the Rubber Chemicals Department, American Cyanamid Company, will be a unit of Calco Chemical Division. Rubber chemicals will be sold through the same distributors as in the past.

Sales Representatives: Akron Chemical Company, Akron, Ohio • Ernest Jacoby & Company, Boston, Mass. Herron & Meyer, Chicago, Ill. • H. M. Royal, Inc., Los Angeles, Calif. • H. M. Royal, Inc., Trenton, N. J. • In Canada: St. Lawrence Chemical Company, Ltd., Montreal and Toronto

Calco

Rubber Chemicals Department
CALCO CHEMICAL DIVISION
AMERICAN CYANAMID COMPANY
Bound Brook, New Jersey

OBITUARY

W. A. M. Vaughan

DEATH came on Christmas Eve to W. A. M. Vaughan, former vice president and treasurer of Seiberling Rubber Co., Akron, O., at his home in Akron. Ill for nearly two years, he had resigned from the Seiberling company in December, 1945.

Born in Kansas City, Mo., in 1879, he was educated in public schools and worked for a short time in the real estate business. In 1901 he went to Cuba to become cashier at the National Bank of Cuba at Havana, where he held various positions in the bank until 1914, when he returned to Kansas City.

In 1917, Mr. Vaughan joined the Goodyear Tire & Rubber Co., Akron, and was sent by F. A. Seiberling, then president of Goodyear, to Sumatra to superintend the opening of the first Goodyear rubber plantation there. He remained in Sumatra for three years, returning to the United States in 1919 to become treasurer of the Goodyear Tire & Rubber Co. of California.

When F. A. Seiberling stepped out as head of Goodyear in 1921 and founded Seiberling Rubber Co., Mr. Vaughan joined him in the venture as treasurer of the company. He remained at Seiberling as treasurer until 1926, when he left to become executive vice president of the Second National Bank of Akron. In 1932, however, the deceased returned to Seiberling as treasurer and remained there until ill health forced his resignation.

Mr. Vaughan belonged to the Portage Country and Akron City clubs and had been a member of the Ohio Bankers' Association and a director of the Chamber of Commerce.

He leaves his wife, two daughters, and three grandchildren.

Funeral services were held at his late residence on December 26.

Maurice L. Allard

MAURICE LOUIS ALLARD, for the past 20 years technical superintendent of the U. S. Rubber Reclaiming Co., New York, N. Y., died on December 16 after a prolonged illness. Born in Brussels, Belgium, August 10, 1881, Mr. Allard came to Canada in 1900 to embark on his career as a rubber technologist under the tutelage of Harold Van der Linde at the Gutta Percha Rubber Co., Ltd., Toronto, Ont. Dr. Van der Linde's laboratory, incidentally, was the first rubber laboratory in Canada.

In 1910, Dr. Van der Linde formed the Century Plainfield Tire Co. in Plainfield, N. J., where Mr. Allard assisted in the development of revolutionary tire designs, a number of which have been incorporated in present-day manufacturing. In 1914 he joined the staff of Dunlop Tire & Rubber Goods Co., Ltd., Toronto, and shortly was sent on a mission to England and thence to the Far East, where he traveled extensively through the plantations of Malaya and the Islands. His experience in the plantations stood him in good stead in subsequent work at Dunlop, where he remained as assistant plant superintendent for some years. In 1920 the deceased returned to Belgium for a brief stay, and later that year joined the Gutta Percha company as superintendent

Maurice L. Allard

of the planning department, a post he held until 1926. From then until his death he was technical superintendent at the Buffalo, N. Y., laboratory of U. S. Rubber Reclaiming Co.

Fred Zonino

FRED ZONINO, chief industrial engineer of United States Rubber Co.'s footwear division, died December 1 of cerebral hemorrhage in Waterbury, Conn. He was 50 years old.

Mr. Zonino had been associated with the rubber company since 1903 when he started work in the New Brunswick, N. J., plant. After various promotions he went to the Naugatuck, Conn., footwear plant in 1929 as head of the planning department. Then in 1945 he was appointed chief industrial engineer of the footwear division. He was an expert on factory production layouts and wage incentive systems. During industry's conversion from civilian to war production he developed several new methods for manufacturing war products for the rubber company. Since the war he made invaluable contributions to the reconversion program.

He leaves his wife, two sons, two sisters, and a brother.

Ernest Hart Jeffords

ERNEST HART JEFFORDS, recently retired director of Raybestos-Manhattan, Inc., Passaic, N. J., and general manager of the General Asbestos & Rubber Division, North Charleston, S. C., died at his home in Charleston, S. C. on December 12.

He was born in Charleston on September 5, 1875, and attended Porter Military Academy and the Military College of South Carolina (The Citadel), from which he was graduated in 1894. He worked as a bank clerk and then as a bookkeeper and cashier for an ice company before joining the General Asbestos & Rubber Co. on November 15, 1917, as a bookkeeper. Ten years later he became vice president and general manager of the company. In 1929, General Asbestos merged with the Manhattan Rubber Mfg. Co. and other companies to form Raybestos-Manhattan, Inc., the company of which he became director.

Mr. Jeffords was a member of the Charleston Club, the Knights of Pythias, F. & A. M., St. Andrews and Hiberman Societies, and the Scottish Rite.

A bachelor, he leaves a sister and a brother.

Funeral services were held on December 13 at Grace Protestant Episcopal Church, followed by burial at Magnolia Cemetery, Charleston.

William B. Gold

WILLIAM B. GOLD, purchasing agent, The Electric Storage Battery Co., Philadelphia, Pa., died suddenly on December 15. Mr. Gold, who was 66 years old, had entered the employ of the company in 1900 and in 1913 became purchasing agent.

He was one of the organizers of the Philadelphia Association of Purchasing Agents and had been its president and director for several years. He was also a founder of the National Association of Purchasing Agents, serving as its vice president and director. Besides Mr. Gold was very active in Philadelphia affairs and a member of several clubs, including the Union League, the Sons of the Revolution, the Downtown, the Contemporary and the Bachelors Barge clubs, and the New Jersey Society of Pennsylania. He was a director of the Philadelphia Forum, the Penn Club, and a member of the Philadelphia Committee of the Pennsylvania Economy League. He was also a director of Warren Ehret Co.

He is survived by his wife.

Harry Sagrans

THE owner of the Sagrans Adhesive & Chemical Co., Wakefield, Mass., Harry Sagrans, died at his home there on November 30 from coronary thrombosis. He was born in Russia on February 23, 1886. Mr. Sagrans, who was educated in the public schools of Haverhill, Mass., settled in Wakefield in the Fall of 1936 and began manufacture of latex and rubber cement for shoe factory operations. He had been in the adhesive business for about 25 years before his death.

Funeral services were held at Levine Chapel, Brookline, Mass., on December 2, with burial at Dedham, Mass.

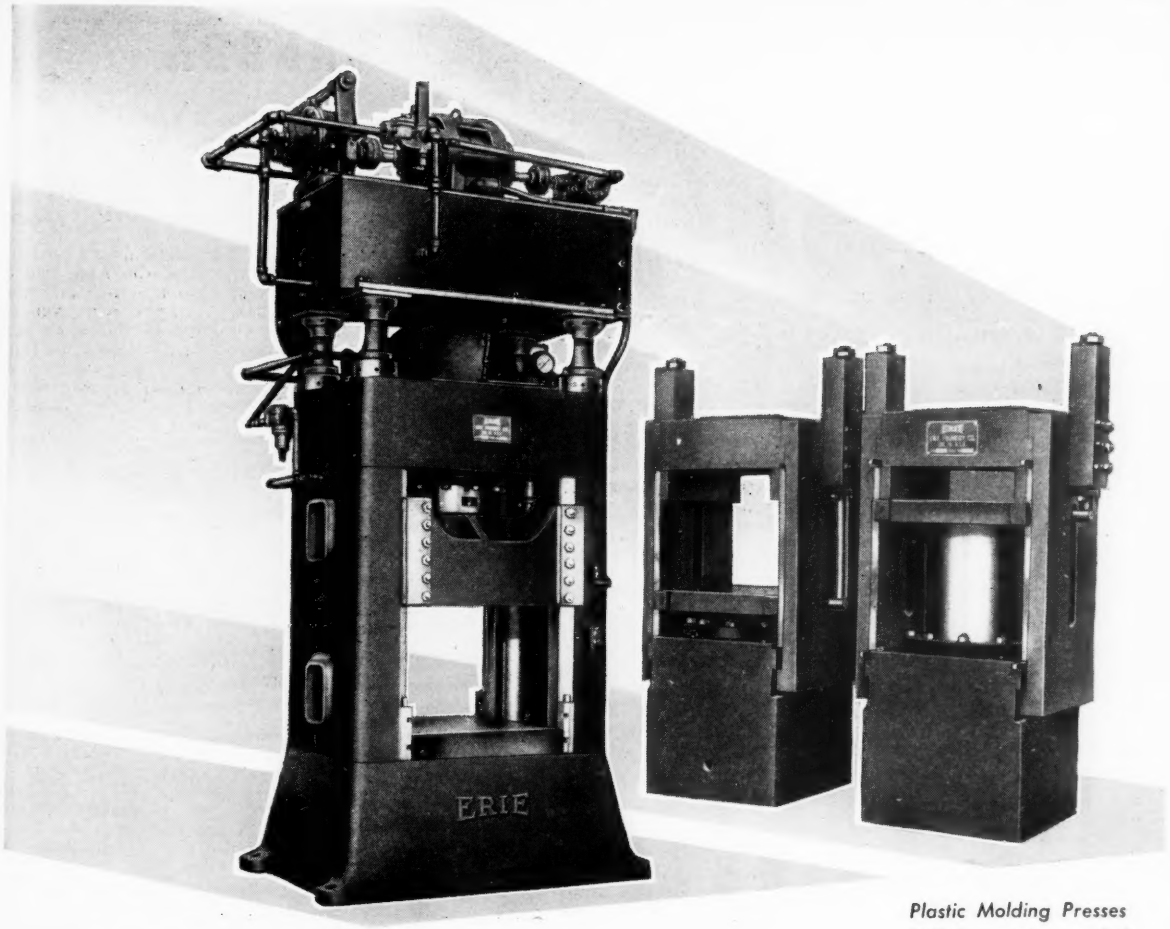
Mr. Sagrans leaves a wife, three daughters, and two sons. One of his daughters, Leah, was a partner with her father in the Sagrans Adhesive & Chemical Co.

John T. Ryan

JOHN T. RYAN branch operating manager of the Philadelphia branch of United States Rubber Co., died suddenly December 27 at his home in Drexel Hill, Pa. Affiliated with U. S. Rubber for 39 years, Mr. Ryan spent most of that time in the company's distributing branches department with additional service in the footwear division and export company. Before going to Philadelphia in 1943 he had been assistant branch operating manager at Boston and manager at Syracuse.

Mr. Ryan was born in Paterson, N. J., 56 years ago. He was a member of the Knights of Columbus and a past president of the Holy Name Society in Hoboken, N. J.

Surviving are his wife, two sons, a sister, and a brother.



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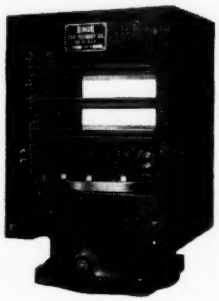

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FINANCIAL

Boston Woven Hose & Rubber Co., Cambridge, Mass. Year ended August 31, 1946: net earnings, $498,671, equal, after taxes and preferred dividends, to $5.28 a common share, contrasted with $426,889, or $4.44 a share, in the preceding fiscal year; income and excess profits taxes, $463,500, against $943,000; sales, $11,243,306 against $11,387,266; current assets, $6,079,473, current liabilities, $1,073,126, against $6,284,519 and $1,457,234, respectively, on August 31, 1945.

Crown Cork & Seal Co., Inc., Baltimore, Md., and wholly owned domestic subsidiaries. First nine months, 1946: net income, $2,085,840, equal to $2.77 a common share, against $2,089,096, or $2.83 a share last year; net sales, $45,677,694, against $52,206,001.

Detroit Gasket & Mfg. Co., Detroit, Mich. First half, 1946: net income, $97,403, equal to 40c each on 214,250 common shares.

Eagle-Picher Co., Cincinnati, O. Nine months ended August 31, 1946: net profit, $1,113,602, equal to $1.25 a share, against $1,105,942, or $1.24 a share, a year earlier; sales, $28,497,663, against $31,210,030.

General Cable Corp., New York, N. Y. First nine months, 1946: net income, $1,333,719, equal to 35¢ a common share, against $1,509,015, or 48¢ a share, in the corresponding period of 1945.

General Electric Co., Schenectady, N. Y. Nine months ended September 30: $404,109, equal to 1¢ a common share, compared with $36,242,727, or $1.26 a share, in the like period last year; net sales billed, $421,439,436, against $948,432,369.

General Motors Corp., Detroit, Mich. Third quarter, 1946: net profit, $33,816,460, equal to 71¢ a common share, against $36,791,784, or 78¢ a share, in the corresponding period a year ago.

Hercules Powder Co., Wilmington, Del. Nine months ended September 30: net earnings $5,631,636, equal, after preferred dividends, to $2.01 each on 2,633,420 common shares outstanding, contrasted with $4,096,183, or $2.81 each on 1,316,710 common shares, for the same period last year; net sales, $72,453,609, against $80,602,345; reserve for taxes, $3,531,057, against $10,850,641.

Hewitt-Robins, Inc., Buffalo, N. Y. First nine months, 1946: net earnings, $73,570.

Timken Roller Bearing Co., Canton, O. First nine months, 1946: net profit, $1,194,357, or 49¢ a share, against $4,168,578, or $1.72 a share, a year earlier.

The Hydraulic Press Mfg. Co., Mt. Gilead, O. First nine months, 1946: net earnings, $463,990, equal to $2.67 a common share, against $3,353 in the same quarters of 1945; net sales, $5,440,364, against $2,669,207.

Pharis Tire & Rubber Co., Newark, O., and subsidiaries. Eight months to June 30: net profit, $816,659, equal to $3.85 each on 212,000 capital shares; consolidated gross sales, $12,549,267.

Rome Cable Corp., Rome, N. Y. Six months to September 30: net profit, $470,914, equal to $2.39 a common share, against $171,773, or 90¢ a share, in the 1945 period.

Skelly Oil Co., Kansas City, Mo. Nine months to September 30: net income $6,484,106, equal to $6.60 a share on outstanding common stock, compared with $5,359,247, or $5.46 a share, in the 1945 period.

New Incorporations

Beaufort Rubber & Chemical Co., New York, N. Y. To deal in latex and synthetic resins.

Coraco Laboratories, 310 Green Brook Rd., North Plainfield, N. J. Clifford H. Coles, 310 Green Brook Rd., North Plainfield. Chemical consultant and manufacturer of rubber and plastic pharmaceuticals.

Killashun Sales Division, Inc., Wilmington, Del. Capital $25,000. Rubber products.

CANADA

Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., has announced three appointments through R. I. Raycroft, general sales manager. Ernest W. Barbour was named trade sales manager; Stephen F. Palmer, manager of manufacturer's sales; and John W. Fortner, manager of Firestone dealers' stores merchandising division. Mr. Barbour has had 14 years of executive experience and was previously manager of the Vancouver and the London, Ont., branches. Mr. Palmer, formerly manager of truck, bus, and tractor tire sales headed Firestone's war products division during the war years. Mr. Fortner has been with Firestone, Toronto branch, since 1936.

Canadian Eastern & Pacific Co., manufacturer of plastics, has bought the former war plant at Buckingham, P. Q., known as the Electrical ReductionWorks. It has reportedly planned to form, with Lacrinoid Products, Ltd., of London, a new enterprise under the name of Lacrinoid Products (Canada) Ltd., which is expected to start production of plastic materials for export by September, 1947. To begin with, 150 persons will be employed, and 250 within two years.

Sun Chemical Corp. has appointed Natural Products Corp., 738 Marin Avenue, Montreal, exclusive sales agent in Canada for Warwick Wax Co., New York, N. Y., a Sun subsidiary. Natural Products will introduce into the Dominion Cardis 319, a new emusifiable petroleum wax which is replacing high-price vegetable waxes.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
American Wringer Co., Inc.	Com.	$0.30	Jan. 2	Dec. 16
Anaconda Wire & Cable Co.	Com.	2.25	Dec. 19	Dec. 9
Boston Woven Hose & Rubber Co.	Pfd.	3.00 semi-an.	Dec. 16	Dec. 2
Carborundum Co.	Com.	0.50 q.	Dec. 20	Dec. 9
Dayton Rubber Mfg. Co.	Com.	0.30 q.	Jan. 25	Jan. 10
Dayton Rubber Mfg. Co.	Pfd. "A"	0.50 q.	Jan. 25	Jan. 10
Denman Tire & Rubber Co.	Com.	0.10 q.	Jan. 3	Dec. 20
Denman Tire & Rubber Co.	Com.	0.10 extra	Jan. 3	Dec. 20
Denman Tire & Rubber Co.	5% Con. Pfd.	0.12½ q.	Jan. 3	Dec. 20
Detroit Gasket & Mfg. Co.	....	100% stock	Dec. 31	.....
Dunlop Tire & Rubber Co., Ltd.	Com.	1.25	Dec. 20	Dec. 16
Electric Storage Battery Co.	Com.	1.00 yr.-end.	Dec. 31	Dec. 16
Faultless Rubber Co.	New	0.50 init.	Jan. 2	Dec. 16
Faultless Rubber Co.	Com.	0.50	Jan. 2	Dec. 16
Flintkote Co.	Com.	0.80	Dec. 23	Dec. 10
Garlock Packing Co.	Com.	0.25 q.	Dec. 28	Dec. 20
General Cable Corp.	Pfd.	1.00 q.	Jan. 2	Dec. 20
General Cable Corp.	2nd Pfd.	0.50 q.	Jan. 2	Dec. 20
General Tire & Rubber Co.	4½% Pfd.	1.06¼ q.	Dec. 31	Dec. 21
General Tire & Rubber Co.	3¾% Pfd.	0.93¾ q.	Dec. 31	Dec. 21
General Tire & Rubber Co.	3¼% Pfd.	0.81¼ q.	Dec. 31	Dec. 21
Goodyear Tire & Rubber Co. of Canada, Ltd.	Com.	1.00 q.	Dec. 31	Dec. 14
Intercontinental Rubber Co.	Com.	0.25 yr.-end	Jan. 15	Dec. 27
Jenkins Bros.	Pfd.	1.75	Dec. 27	Dec. 13
Jenkins Bros.	Non-Vot.	0.25	Dec. 27	Dec. 13
Jenkins Bros.	Fdrs.	1.00	Dec. 27	Dec. 13
Johnson & Johnson	4% 2nd Pfd.	1.00 q.	Feb. 1	Jan. 16
Johnson & Johnson	8% Pfd.	4.00 s.	Jan. 31	Jan. 31
I. B. Kleinert Rubber Co.	Com.	0.25 q.	Dec. 12	Dec. 1
I. B. Kleinert Rubber Co.	Com.	0.25 extra	Dec. 23	Dec. 13
Midwest Rubber Reclaiming Co.	Pfd.	0.56¼ q.	Jan. 2	Dec. 18
Minnesota Mining & Mfg. Co.	Com.	0.30 extra	Dec. 30	Dec. 19
Mohawk Rubber Co.	Com.	0.50 extra	Dec. 20	Nov. 30
Norwalk Tire & Rubber Co.	Com.	0.37½ yr.-end	Feb. 28	Feb. 13
O'Sullivan Rubber Co., Inc.	Com.	0.10 q.	Jan. 1	Dec. 21
O'Sullivan Rubber Co., Inc.	Pfd.	1.25 q.	Jan. 1	Dec. 21
Pharis Tire & Rubber Co.	Com.	0.15 new	Jan. 10	Dec. 27
Pharis Tire & Rubber Co.	Com.	0.15	Jan. 10	Dec. 27
Raybestos-Manhattan, Inc.	Com.	0.87½	Jan. 3	Dec. 2
Rome Cable Corp.	Com.	0.25	Jan. 2	Dec. 11
Russell Mfg. Co.	Com.	0.50 extra	Dec. 14	Nov. 30
Russell Mfg. Co.	Com.	0.37½ q.	Dec. 14	Nov. 30
Seiberling Rubber Co.	Com.	0.25	Jan. 1	Dec. 10
Seiberling Rubber Co.	4¼% Pfd.	1.12 q.	Jan. 1	Dec. 10
Seiberling Rubber Co.	Pfd. "A"	1.25	Jan. 1	Dec. 10
United Elastic Corp.	Com.	0.75	Dec. 10	Nov. 23

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APPLICATION

United States

2,409,641. **Ventilating Attachment for Welders' Helmets Including an Air Hose and a Pair of Air Hose Sections Attached Respectively to the Rear and Sides of a T-Fitting on a Headband of the Helmet.** W. D. O'Quinn, Wilmington, N. C.

2,409,653. **In a Toy Rocket Gun, a Rubber Sealing Disk and Air Pressure Charging Means.** L. H. Amdur, Brooklyn, N. Y.

2,409,728. **In a Sand Trap Including a Sand-Inlet Connection Leading to a Sand-Retaining Chamber Intersected by an Open-Ended Transverse Passage, an Ejector Assembly Insertable into the Passage, and Including a Jet Nozzle with Air Supply Connections and a Venturi Throat of Rubber-like Material.** W. A. Baldwin, Watertown, N. Y., assignor to New York Air Brake Co., a corporation of N. J.

2,409,734. **Apparatus for Blood Transfusion.** R. Bucher, assignor to G. Laubscher & Co., both of Basel, Switzerland.

2,409,808. **In Combination with a Laminated Glazing Unit, Flat, Plastic Means Bonded to the Outer Surfaces of the Panes to Provide an Adhering, Leakproof Gasket.** C. E. Sowle, Van Nuys, assignor to Lockhead Aircraft Corp., Burbank, both in Calif.

2,409,823. **Eyelash Buffer Including a Sponge Rubber Bar and Holder therefor.** C. J. Altman, Detroit, Mich.

2,409,869. **Fountain Pen.** J. J. Kelley, St. Louis, Mo.

2,409,922. **In a Shaft Sealing Construction Including a Wall and a Shaft Opening, a Rubber Wall Member Extending across the Opening and Provided with a Bore Rotatably Fitting the Shaft.** E. R. Zademach, Elizabeth, and W. W. Clarke, Summit, assignors to Metalwash Machinery Corp., Newark, all in N. J.

2,409,964. **In a Storage Battery Cell Assembled in a Hermetically Sealed Container, and Including a Non-Spill Vent Plug Embodying an Automatically Closing Valve, Means for Relieving Pressure Produced in the Interior of the Cell When the Valve Is Closed; These Means Include a Reservoir Bounded by Flexible Resilient Walls and Supported Externally to the Cell.** W. W. Smith, Philadephia, Pa., assignor to Electric Storage Battery Co., a corporation of N. J.

2,410,031. **Thermohydrometer Including a Barrel Carrying a Collapsible Bulb and a Nozzle.** A. Z. Hover, Conshohocken, Pa., assignor, by mesne assignments, to Kimble Glass Co., Vineland, N. J.

2,410,082. **Ventilated Corset Including Elastic Strips and a Sheet of Porous, Extensible Fabric Attached to Upper and Lower Horizontal Strips.** J. I. Kisner, Branford, Conn.

2,410,174. **In a Wheel Structure, a Cover Assembly Including a Self-Sustaining Resilient Readily Flexible Part.** G. A. Lyon, Allenhurst, N. J.

2,410,200. **Cigarette Container Including a Bendable Band Conformable to a Portion of the Human Body, and Waterproof Pockets in the Band.** W. E. Celestin, New York, N. Y.

2,410,209. **Combined Wheel Rim and Pneumatic Tire.** H. M. Godsey, Crockett, Tex.

2,410,367. **Receptacle for an Irrigating Douche Including a Sheet of Flexible Waterproof Material Shaped to Form a Bag.** J. Shapiro, Brooklyn, N. Y.

2,410,403. **In an Axle Suspension for Railway Trucks, Members of Resilient Material Like Rubber Bonded to U-Section Metal Members, and Having Metal Lined Vertical Slots Which Hold Narrow Projections on the Axle.** T. Ledwinka, assignor to Budd Co., both of Philadelphia, Pa.

2,410,423. **Fountain Pen.** T. F. Brinson, assignor to Scripto Mfg. Co., both of Atlanta, Ga.

2,410,454. **Voice-Transmitting Gas Mask.** A. V. Motsinger, near Aberdeen, Md.

2,410,460. **Medicinal Applicator and Dispenser of Thin, Flexible Elastic Material.** J. P. Robinson, Tokyo, Japan vested in the Alien Property Custodian.

2,410,472. **Sandblast Stencil of Flexible, Blast-Resistant Rubber Sheet Backing, a Layer of Pressure-Sensitive Adhesive, a Sheet of Treated Cellulosic Material, and a Coating of Cellulose Derivative Adapted to Receive Transfer Impressions.** A. J. Wartha, assignor to Minnesota Mining & Mfg. Co., both of St. Paul, Minn.

2,410,507. **In a Track for Track Laying Vehicles Including Sectional Reinforcing Units and Transverse Reinforcing Plates, a Covering of Rubber over Units and Plates.** R. M. Knight, Chicago, Ill.

2,410,586. **In a Method of Producing Laminated Materials of Asphalt-Saturated Felt, the Use of a Bonding Material, one of the Components of Which Is an Aqueous Rubber Dispersion.** A. R. McGarvey, assignor to Armstrong Cork Co., both of Lancaster, Pa.

2,410,632. **Inflatable Suit.** R. S. Colley, Kent, C. P. Krupp, Akron, and D. H. Shook, Cuyahoga Falls, all in O., assignors to B. F. Goodrich Co., New York, N. Y.

2,410,676. **In Apparatus for Shaping Sheet Metal and Including a Die on a Support, a Rubber Block and Means for Forcing the Rubber Block against the Upper Surface of the Sheet to Form It into the Die.** J. S. Nielsen, Stow, assignor to Goodyear Aircraft Corp., Akron, both in O.

2,410,786. **In a Pressure Suit, a Joint Structure between a Disconnectable Member and the Stub of a Limb Member.** G. D. Mallory, assignor to Wingfoot Corp., both of Akron, O.

2,410,806. **In a Submarine Signal Detector Including a Watertight Fluid-Containing Enclosure Having an Apertured Wall Portion, a Flexible Rubber Diaphragm Arranged to Prevent Water Entering the Enclosure.** R. Black, Jr., South Orange, and F. F. Romanow, Berkeley Heights, both in N. J., assignors to Bell Telephone Laboratories, Inc., New York, N. Y.

2,410,830. **Fluid Pressure Media Dispensing Device Including a Support, Rotatable Means thereon and a Hose Adapted to Be Reeled on to and Unreeled from the Rotatable Means.** S. C. Marsh, Hohokus, assignor to Specialties Development Corp., Bloomfield, both in N. J.

2,410,853. **Shoe Protector Including a Resilient Wear-Absorbing Tread Member.** W. Wood, Jr., Vancouver, B. C., Canada.

2,410,857. **In Apparatus for Forming Material Involving the Application of Pressure and Heat Exchange, a Male Form Including a Plug of Compressible, Resilient Material and a Flexible and Resilient Blanket Associated with the Plug.** W. B. Ahern, DeKalb, assignor to Rudolph Wurlitzer Co., Chicago, both in Ill.

2,410,999. **In a Support for a Bulkhead Conduit, a Seal Consisting of a Cushion of Compressible Material Having a Tubular Extension.** J. H. Reisner, Hagerstown, Md., assignor to Adel Precision Products Corp., a corporation of Calif.

2,411,027. **Belt Including Tension, Neutral Axis and Compression Sections of Rubber Composition Having a Woven Wire Wrapper and Woven Wire Cloth Completely Surrounding the Neutral Axis Section; the Latter Section Includes Parallel Cords along the Longitudinal Axis of the Belt.** M. A. Crosby, assignor to Dayton Rubber Mfg. Co., both of Dayton, O.

2,411,116. **For Forming a Container Material Consisting of a Self Healing Intermediate Layer of Masticated, Partially Cured Rubber and a Synthetic Resin, an Outer Layer of Tough Highly Elastic Vulcanized Rubber, and an Inner Layer of Vulcanized Hydrocarbon-Resistant Synthetic Rubber.** M. Sanz, Los Angeles, Calif., assignor by mesne assignments, to Consolidated Vultee Aircraft Corp., a corporation of Del.

2,411,175. **Elastic Fabric.** A. L. Wagler, North Hills, Pa.; A. Wagler, executrix of A. L. Wagler, deceased, assignor, by direct and mesne assignments, to W. F. Geibel, Philadelphia, Pa.

2,411,240. **Pneumatic Tire with Attachable Tread.** K. C. Alward, Moweaqua, Ill.

2,411,251. **In a Load Responsive Pressure Producing Unit for a Hydraulic Force Measuring Apparatus Including Spaced Upper and Lower Plates with Circular Grooves, a Rubber Ring Gasket Seated in the Grooves to Form a Resilient Seal, thereby Permitting the Unit to Contain a Liquid Subject to Pressure Transmitted by the Plates.** B. D. Feld, Birmingham, Ala.

2,411,279. **In a Friction Shock Absorber, a Friction Post Surrounded by Cylindrical Inherently Resilient Friction Bars.** E. H. Lehman, assignor to W. H. Miner, Inc., both of Chicago, Ill.

2,411,284. **Non-Deteriorating Rubber Insulated Wire.** D. J. Miller, assignor to American Anode, Inc., both in Akron, O.

2,411,316. **Roof Including Cells Inflatable with Buoyant Gas and Releasable Means for Uniting the Cells along Their Edges to Form a Continuous Roof.** E. R. Capita, North Bergen, N. J.

2,411,403. **In Forming a Tortoidal Winding Assembly, the Use of Relatively Stretchable Tapes of Elastic Material.** E. C. Wentz, Sharpsville, assignor to Westinghouse Electric Corp., East Pittsburgh, both in Pa.

2,411,412. **Seat Structure Including Back and Bottom of Soft, Flexible, Extensible Material.** G. W. Blair and J. F. Schott, both of Mishawaka, and W. E. Faulk, Grosse Pointe, assignors to Mishawaka Rubber & Woolen Mfg. Co., Mishawaka, both in Ind.

2,411,479. **Sheet-Like, Stretchable and Resilient Bottom Filler Attached to a Shoe Insole.** I. Tarlow, Brockton, Mass.

2,411,488. **In a Brush for a Suction Cleaner, Bristles Set in a Back of Deformable Material Like Rubber.** H. B. White, assignor to Hoover Co., North Canton, both in O.

Dominion of Canada

437,290-291. **Wheel Cover of Resiliently Flexible Synthetic Plastic Material.** G. A. Lyon, Allenhurst, N. J., U.S.A.

437,307. **Deicer System Including Inflatable Units Mounted along Airfoil Surfaces.** Bendix Aviation Corp., South Bend, Ind., assignee of S. K. Lehman, Brooklyn, N. Y., and M. L. Taylor, Hudson, O., all in the U.S.A.

437,308. **In a Seat for a Saddle, Outer Cover and Base Plate of Synthetic Plastic Material.** Birmingham Small Arms Co., Ltd., assignee of H. J. W. Roll and S. C. Wilsdon, all of Birmingham, England.

437,322. **Textile Print Blanket for Wash Blanket Printing.** Dewey & Almy Chemical Co., Cambridge, assignee of W. C. Ross and S. B. Neiley, both of Winchester, both in Mass., U.S.A.

437,430. **Composite Article Including a Body with a Wood Surface, an Adhesive Film of a Thermoplastic Rubber Composition, Elastic Layer of Vulcanized Rubber, and a Layer of Metal Electrodeposited on the Surface of the Elastic Layer.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of E. L. Scholl, Detroit, Mich., U.S.A.

437,497. **Laminated Heating Unit Including a Sheet of Flexible Material to Which Is Applied a Synthetic Resin Compound Containing Electrically Conducting Carbon Black, and Electrical Conducting Wires along Two Edges of the Sheet; the Whole Is Enclosed in and Bonded to a Pair of Protective Layers of Resin Coated Material.** Dominion Rubber Co., Ltd., Montreal, P.Q., assignee of L. Marick, Grosse Pointe Farms, Mich., U.S.A.

437,542-544. **In a Wheel Structure, a Cover Assembly of Synthetic Plastic Material.** G. A. Lyon, Allenhurst, N. J., U.S.A.

437,578. **Metal Rim to Which a Solid Rubber Tread Is Directly Bonded.** Andre Rubber Co., Ltd., assignee of T. Gillett, both of Surbiton, Surrey, England.

437,608. **In a Bearing, a Housing Having, as Lining, Staves of Laminated Fibrous Material Impregnating with Heat-Hardening Resinoid.** Canadian Westinghouse Co., Ltd., Hamilton, Ont., assignee of V. E. Enz, Turtle Creek, Pa.

437,609. **In a Bearing, a Housing Having, as Lining, Staves of Laminated Fibrous Material Impregnating with Heat-Hardening Resinoid.** Canadian Westinghouse Co., Ltd., Hamilton, Ont., assignee of A. J. Bastian, East Orange, N. J., U.S.A.

437,618. **For Packaging and Sealing Articles, a Strip of Paper, One Side of Which Is Coated with an Aqueous Dispersion of Latex in a Partially Set-up State, and a Second Strip of Paper for the Other Side of the Rubber; the First Sheet and the Latex Coating Are Readily Separable from the Second Sheet of Paper.** Copeman Laboratories Co., assignee of H. Y. Jennings, both of Flint, Mich., U.S.A.

437,623. **Wall Covering Consisting of Similar Extruded Plastic Sections.** Extruded Plastics, Inc., Norwalk, assignee of C. E. Slaughter, New Canaan, both in Conn., U.S.A.

437,676. **Electric Insulating Material Consisting of Starch and China Clay Mixed with Water to Which Oleaginous Synthetic Resin Is Added.** Joseph Sankey & Sons, Ltd., Bilston, Stafford, assignee of G. W. Stockton, Birmingham, both in England.

437,706. **Garment Shield of Synthetic Resin.** A. P. Devor, Toronto, Ont.

437,785. **In a Flush Tank, a Resilient Liner Having Resilient Partitions Formed on One of Its Surfaces for Airtight Engagement with the Inner Surface of the Tank.** Crane Co., Chicago, assignee of R. H. Zinkil, Oak Park, and T. P. Newman, Geneva, all in Ill., U.S.A.

United Kingdom

579,942. **Fuel Containers of Laminated Material.** Imperial Chemical Industries, Ltd.

579,975. **Removable Tread Blocks for Endless Tracks for Vehicles** Wingfoot Corp.

579,992. **Flexible Hand Covering.** B. F. Goodrich Co.

580,006. **Tanks for Fuel or Other Liquids, Especially for Use in Aircraft.** G. H. Farmer.

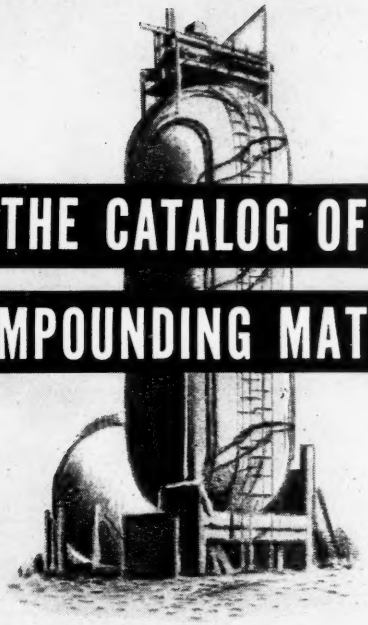
580,121. **Impregnated Leather.** W. Walker & Sons, Ltd., J. R. Alexander, D. Burtin, and F. Hausmann.

580,211. **Oil Seals for Shafts, Etc.** W. Murray.

580,228. **Resilient Fabric, Mattresses, Sealing Surfaces, Anti-Torpedo Nets, Etc.** F. W. Berry, W. Quilter, and J. S. Wilkerson.

580,395. **Resilient Wheels for Vehicles.** Dunlop Rubber Co., Ltd., B. W. D. Lacey, and H. R. Willcocks.

580,628. **Fountain Pens.** Wyvern Fountain Pen Co., Ltd., M. S. Finburgh, and W. T. Higgins.



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BARDOL*

Bardol is a distillate from coal tar. It is entirely liquid and easy to handle in the factory down to as low as 40°F.

Specifications

Specific Gravity @ 25C/25C		1.07 to 1.12
Specific Viscosity, Engler, 50 ml. @ 25C		4.0 maximum
Flash Point, Open Cup	deg. Fahr.	200 minimum
Insoluble in Benzene	% by weight	0.5 maximum
Distillation		
To 210 C	% by weight	1.0 maximum
To 235 C	"	10.0 maximum
To 300 C	"	30.0 to 60.0
To 355 C	"	60.0 minimum
Water	% by volume	1.0 maximum

Bardol is a softener and plasticizer of the solvent and swelling type. It is a particularly fine processing agent, especially for GR-S and crude rubber.

Available in: Tank cars and 50-55 gallon non-returnable steel barrels.

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580,818. **Inserts for Incorporation into Molded Plastic Materials.** Stalybridge Rubber Co., Ltd., and J. H. Ranells.
580,851 and 580,875. **Liquid Fuel Containers** L. Shakesby, J. T. Watts, and Imperial Chemical Industries, Ltd.
580,878. **Booster Brake.** Wingfoot Corp.
581,002. **Liquid Fuel Containers.** W. J. S. Naunton, J. T. Watts, and Imperial Chemical Industries, Ltd.
581,025. **Transmission Belts of Trapezoidal Cross-Section.** Wingfoot Corp.
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581,128. **Electric Cables.** Commercial Secretaries, Ltd., and H. A. Tunstall.
581,159. **Pneumatic Tires.** United States Rubber Co.
581,283. **Brake and Clutch Apparatus.** Dunlop Rubber Co., Ltd., and H. W. Tregaskis.
581,340. **Pressure-Sensitive Adhesive Tapes.** Minnesota Mining & Mfg. Co.
581,449. **Pressure-Sensitive Sheets and the Like.** E. I. du Pont de Nemours & Co., Inc.
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581,522. **Resilient Suspension of Works' Trucks and Similar Vehicles.** Rubery, Owen & Co., Ltd., and D. D. Arnott.
581,593. **Sealing Devices for Fluid Pressure Devices.** Automotive Products Co., Ltd., and W. H. J. Brock.
581,615. **Sealing Rings for Machinery Bearings.** Super Oil Seals & Gaskets, Ltd., and L. A. Moxon.
581,624. **Brake and Clutch Mechanism.** Dunlop Rubber Co., Ltd., and H. J. Butler.
581,723. **Electric Cables.** W. T. Henley's Telegraph Works Co., Ltd., and E. Moor.
581,803. **Vibration Damping Supports for Machines, Etc.** T. B. Andre Rubber Co., Ltd., and R. D. French.
581,804. **Shockproof Mountings and Supports for Machines and the Like.** T. B. Andre Rubber Co., Drysdale & Co., Ltd., and J. W. W. Drysdale.
581,810. **Vehicle Tires.** J. Urmston.
581,867. **Combined Pen and Pencil Clip and Rubber Holder.** H. Terry & Sons, Ltd., and N. V. Terry.

PROCESS

United States

2,409,759. **Bonding a Completely Cured Metal-Adherent Rubber Composition Directly to a Cuprous Alloy Article.** O. W. Hosking, Monroe, N. Y., assignor to Composite Rubber Products Corp., Bridgeport, Conn.
2,409,361. **Plastic Articles.** A. W. Prance, Royal Oak, assignor to Briggs Mfg. Co., Detroit, both in Mich.

Dominion of Canada

437,407. **Poppet Valve of Synthetic Rubber.** J. Rodway, Lincoln, England.
437,484. **Wire Coated with a Normally Solid Polymer of Ethylene.** Canadian Industries, Ltd., Montreal, P. Q., assignee of E. G. Williams, Northwich, Cheshire, England.
437,622. **Preventing Warping or Bowing of Extruded Thermoplastic Synthetic Resin Strips.** Extruded Plastics, Inc., Norwalk, assignee of C. E. Slaughter, New Canaan, both in Conn., U.S.A.
437,639. **Insulating Hollow Body from Laminated Fibrous Material Impregnated with a Permanently Thermoplastic Synthetic Resin.** International Standard Electric Corp., New York, N. Y., assignee of T. R. Scott and E. C. Lee, both of London, England.

United Kingdom

581,134. **Adhesively Uniting Materials.** D. A. Harper, and Imperial Chemical Industries, Ltd.
581,181. **Welding Plastics by High-Frequency Electric Fields.** G. Haim and H. P. Zade.
581,210. **Bag.** Wingfoot Corp.
581,492. **Electrically Insulated Wire.** Pirelli-General Cable Works, Ltd., and H. Barron.
581,520. **Bonding Fabrics to Natural and Synthetic Rubber.** T. J. Meyrick, J. T. Watts, and Imperial Chemical Industries, Ltd.
581,526. **Heat-Treating and Stretching Untwisted Yarn Consisting of a Polymer of Acrylonitrile.** E. I. du Pont de Nemours & Co., Inc.
581,764. **Flexible Walled Containers and Forms Used therein.** Hewitt Rubber Corp.
581,830. **Electric Cables.** Callender's Cable & Construction Co., Ltd., and A. King.

CHEMICAL

United States

2,409,633. **Polymerizable Composition Including an Unsaturated Alkyd Resin, Triallyl Phosphate and a Catalyst for Accelerating Copolymerization.** E. L. Kropa, Old Greenwich, Conn., assignor to American Cyanamid Co., New York, N. Y.
2,409,671. **Oil-Soluble Polyalkyl Aromatic Sulfonate.** J. Faust, Belleville, N. J., assignor to L. Sonneborn Sons, Inc., a corporation of Del.
2,409,679. **Polymer of Ethylene and Methyl Alphachloracrylate Having an Ethylene to Ester Mol Ratio of 1.9:1.** W. E. Hanford, Wilmington, and J. R. Roland, McDaniel Heights, assignors to E. I. du Pont de Nemours & Co., Inc., Wilmington, both in Del.
2,409,685. **Addition Product of an Alkylene Imine Having Its Imino Nitrogen Atom Attached to Two Carbon Atoms Directly Connected One to Another, with Zinc Salt of a Heterocyclic Nitrogen-Containing Mercaptan.** P. C. Jones, near Chagrin Falls, and R. A. Mathes, Akron, both in O., assignors to B. F. Goodrich Co., New York, N. Y.
2,409,699. **Cyanomethyl Dialkyl Orthoformate.** D. J. Loder and W. F. Gresham, assignor to E. I. du Pont de Nemours & Co., Inc., all of Wilmington, Del.
2,409,727. **Production of Tetra-Isobutylene by Polymerization of Di-Isobutylene without Formation of Substantial Amounts of Tri-Isobutylene, Which Includes Subjecting Di-Isobutylene in the Liquid Phase to the Action of Phosphorus Pentoxide.** G. C. Bailey, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Del.
2,409,781. **In Extractive Distillation, the Improvement Which Consists in Preventing the Corrosion of Equipment and Polymerization of Furfural Used as Selective Solvent by Adding an Alkaline Material from the Group of Bicarbonates of the Alkali Metals at a Controlled Rate and Continuously to the Furfural to Maintain the Acidity in the Range of pH 4.0 to pH 5.2.** V. Mertz, Dallas, Tex., assignor to Phillips Petroleum Co., a corporation of Del.
2,409,809. **Cured Butadiene-Styrene Synthetic Rubber with Superior Aging Properties.** L. R. Sperberg, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Del.
2,409,828. **Condensation Product of a 2-Carboxylic Amidothiazole and at Least one Mol Each of Formaldehyde and a Strongly Basic, Non-Aromatic Amine.** L. H. Bock, Huntingdon Valley, Pa., H. C. E. Johnson, New York, N. Y., and L. J. Armstrong, assignors to Rohm & Haas Co., both of Philadelphia, Pa.
2,409,829. **Alkylene Bis-Ureas.** W. R. Boon, Blackley, Manchester, England, assignor to Imperial Chemical Industries, Ltd., a corporation of Great Britain.
2,409,906. **Reaction Product of Ingredients Including an Aminotriazine-Aldehyde Addition Product and a Primary Mono-Amino-Diphenyl Free from Aldehyde-Reactive Substituents.** M. J. Scott, Springfield, Mass., assignor to Monsanto Chemical Co., St. Louis, Mo.
2,409,910. **Filling a Container with a Cellular Mass of a Solid Vinyl Aromatic Resin.** K. E. Stober, assignor to Dow Chemical Co., both of Midland, Mich.
2,409,915. **Emulsion Polymerization of a Mixture of Butadiene and Acrylonitrile.** B. M. Vanderbilt, Cranford, and R. F. Howe, Elizabeth, both in N. J., assignors, by mesne assignments, to Jasco, Inc., a corporation of La.
2,409,930. **Subjecting Primary Oleoresin Acids Containing Levoprimaric Acid, in Solution in a Volatile Solvent, to Reaction with Maleic Anhydride, Separating the Resultant Precipitated Crystalline Maleic-Anhydride-Resin Acid Adduct from the Solution, and Recovering a Resinous Material from the Residual Solution.** R. F. B. Cox, assignor to Hercules Powder Co., both of Wilmington, Del.
2,409,948. **Copolymerization Product of a Mixture of a Perhaloethylene Containing at Least Two Fluorine Atoms, Vinyl Fluoride, and a Hydrogen-Containing Halogenated Ethylene Other Than Vinyl Fluoride.** E. L. Martin, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.
2,409,985-986. **Non-Blocking Melt-Coating Composition Consisting of a Heat-Stable Butyric Acid Ester of Cellulose, Di-2-Ethyl Hexyl Phthalate, Wax, and a Blending Agent from the Group of the Pentaerythritol Esters of Rosin and the Rosin-Maleic Acid-Glycerol Resins.** M. Salo, assignor to Eastman Kodak Co., both of Rochester, N. Y.
2,409,996. **Polymerization of Ethylene at a Temperature between 100 and 400° C. and a Pressure between 400 and 3000 Atmospheres in the Presence of an Alkyl Hydroperoxide.** M. J. Roedel, Tallevville, assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, both in Del.
2,410,042. **Purifying a Hydrocarbon Oil Containing a Styrene Compound: This Hydrocarbon Oil Was Produced by Cracking a Gas Oil.** G. R. Bond, Paulsboro, N. J., assignor to Houdry Process Corp., Wilmington, Del.
2,410,048. **Diolefinic Hydrocarbons.** D. L. Campbell, Short Hills, N. J., assignor to Standard Oil Development Co., a corporation of Del.
2,410,053. **Adhesive Composition Including Rubber, a ThermoSoftening Rubber-Compatible Resin Adapted to Produce Tack, and a Minor Proportion of an Oil-Soluble Heat-Advancing Rubber-Reactive Phenol-Aldehyde Resin.** R. G. Drew, assignor to Minnesota Mining & Mfg. Co., both of St. Paul, Minn.
2,410,073. **Forming Polyesters of High Molecular Weight from a Reaction Mixture of Dihydroxy Alkanes and Dicarboxy Hydrocarbons.** J. B. Howard, Summit, N. J., assignor to Bell Telephone Laboratories, Inc., New York, N. Y.
2,410,078. **Coating Composition Consisting of Broken-Down Rubber, Compatible Resin Adapted to Increase the Cementing Action on Fibers of Fabric, and an Organic Accelerator of the Thiuram Polysulfide Type and an Activator therefor.** W. Kellgren, assignor to Minnesota Mining & Mfg. Co., both of St. Paul, Minn.
2,410,079. **Pressure-Sensitive Adhesive from Rubber Obtained by Breaking Down the Rubber Until It is Sticky and Pasty and Vulcanizing It until It Is More Cohesive Than Adhesive, but Still Tacky.** W. Kellgren, assignor to Minnesota Mining & Mfg. Co., St. Paul, Minn.
2,410,089. **Adhesive Tape Including a Flexible Porous Paper Impregnated and Unified by a Relatively Non-Tacky, Non-Hygroscopic Copolymer of a Vinyl Ester and a Neutral Ester of an Ethylene-Alpha, Beta-Dicarboxylic Acid.** W. E. Lundquist and W. Kellgren, assignors to Minnesota Mining & Mfg. Co., all in St. Paul, Min.
2,410,103. **Elastic Composition Produced by Dissolving Polymeric Methyl Ester of Acrylic Acid in Benzene, Passing Bromine into the Solution, Separating the Treated Polymer from the Benzene, Mixing It with Sodium Sulfide, Molding, and Vulcanizing.** L. W. Rainard, Cochituate, Mass., assignor, by mesne assignments, to National Dairy Products Corp., New York, N. Y.
2,410,187. **Metal Protective Pigmented Coating Including Calcium Chromate and, as a Vehicle therefor, a Member of the Group of an Alkyd Resin and a Phenol Formaldehyde Resin.** C. K. Sloan, Thornton, Pa., and G. P. Patterson, assignors to E. I. du Pont de Nemours & Co., Inc., both of Del.
2,410,205. **Ligneous Resinous Composition.** M. R. Dusenbury, assignor to Hercules Powder Co., both of Wilmington, Del.
2,410,225. **Producing Resin Coatings by Feeding into a Flame-Spraying Device along with a Fuel Gas and Oxygen, an Organic Thermoplastic Material Including a Polymer from the Group of Polyvinyl Butyral Resins, Fusible Ethylene Polymers, Containing Cyclorubber, and Methyl Methacrylate Polymers Free of Material Soluble in Ethyl Alcohol, and Spraying upon a Surface.** M. L. Macht, Jersey City, and M. M. Renfrew, Arlington, both in N. J., assignors to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
2,410,305. **Resinous Composition Including a Polymer of an Ester of an Organic Acid from the Group of Carbonic Acid and Orthocarboxylic Acids.** H. J. Richter, and H. S. Rothrock, assignors to E. I. du Pont de Nemours & Co., all of Wilmington, Del.
2,410,395. **Composition Including an Incompletely Reacted Self-Curing Synthetic Resin Combined with a Latent Curing Catalyst Including Olefin-Sulfur Dioxide Polymer.** L. Smidth, New York, N. Y., assignor to Sylvania Industrial Corp., Fredericksburg, Va.
2,410,401. **Thiophene.** D. D. Coffman, Lindamere, assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, both in Del.
2,410,408. **Preventing Polymerization of a Styrene Monomer by Incorporating therein a Monosulfide of a Dihydric Phenol.** J. R. Surland, Nitro, W. Va., assignor to Monsanto Chemical Co., St. Louis, Mo.
2,410,414. **Resin Composition Including a Homogeneous Mixture of a Polyvinyl Acetal Resin and an Organic Complex of the Werner Type in Which a Trivalent Chromium Atom Is Coordinated with a Carboxylic Acido Group Having at Least 10 Carbon Atoms.** C. W. Johnson, New Brunswick, N. J., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
2,410,418. **Modified Alkyd Resin Obtained by Incorporation of p-Toluene Sulpho-Chloride.** L. Auer, South Orange, N. J.
2,410,425. **Polydihydronorpolycyclopentadienyl Ester of a Polybasic Organic Carboxylic Acid.** H. A. Bruson, assignor to Resinous Products & Chemical Co., both of Philadelphia, Pa.
2,410,445. **Producing a Diolefin by Reacting an Alcohol and an Acetylenic Hydrocarbon at from 200 to 600° C. in the Presence of a Dehydrating and Dehydrogenating Catalyst Consisting of at Least One Oxide from the Group of Alumina, Thoria, Magnesia, and Silica.** V. N. Ipatieff and H. Pines, Riverside, Ill., assignors to Universal Oil Products Co., Chicago, Ill.
2,410,496. **Separating Butadiene from a Solution of Cuprous-Cupric Ammonium Acetate Containing an Excess of Ammonia.** R. A. Graf.

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Monel Metal	Straight-Warp	Framing	Ribbons
Nickel	Stranded	Galvanizing	Rolls
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2,410,595. **Rubber-Like Products from 1.3 Butadiene and Sulfur Heated in a Closed Vessel at from 70 to 160° C. for One Hour to 100 Hours; the Relative Proportions of Butadiene and Sulfur Are from One Part Butadiene and One Part Sulphur to One Part Butadiene and Nine Parts Sulfur.** R. F. Bacon, Bronxville, and R. Fanelli, New Rochelle, assignors to Texas Gulf Sulphur Co., New York, all in N. Y.

2,410,605. **Production of Interpolymer of Isobutylene and Methyl Acetylene by Subjecting a Mixture of These Substances to the Action of Boron Trifluoride at a Temperature below —10° C.** D. W. Huebner and J. E. Fearey, Norton-on-Tees, England, assignors to Imperial Chemical Industries, Ltd.

2,410,623. **Tacky Composition Including a Rubber-Like Polymer of a Diene Hydrocarbon Mixed with a Resinous Product Obtained by Condensing a Single Aldehyde in the Presence of a Condensation Catalyst with a Crotonaldehyde-Type of Auto-Condensation Product of a Lower Aliphatic Ketone.** S. A. Ballard and J. A. Perona, Oakland, Calif., assignors to Shell Development Co., San Francisco, Calif.

2,410,633. **Butadiene-Styrene Copolymerization Process.** T. B. Counselman, Evanston, Ill., assignor to Dorr Co., New York, N. Y.

2,410,661. **Alkylated Product Obtained by Making a Dilute Solution of Natural Rubber in Lower Saturated Liquid Aliphatic Hydrocarbon from the Group of Isobutene and Isopentane, Introducing Boron Trifluoride in the Presence of a Small Proportion of Water and Precipitated Nickel Catalyst at a Temperature Less Than 100° F.** W. F. Hupke, New York, assignor to West Disinfecting Co., Long Island City, both in N. Y.

2,410,681. **For a Metal Container for a Corrosive Electrolyte, a Solid Thermoplastic Lining Consisting of Reclaimed Rubber, Clay, Mineral Rubber, Cumar Resin, and Paraffin Adhered to the Container by Means of a Layer of Adhesive Material Consisting of about 38% of Material Similar to the Thermoplastic Lining and the Balance Rosin Oil and Viscous Asphaltic Material.** V. A. Rayburn, Baltimore, Md., assignor to Western Electric Co., Inc., New York, N. Y.

2,410,714. **Dielectric Composition Including by Weight about 20 to 60 Parts of Dinaphthyl Sulfone and 80 to 40 Parts of Chlorinated Diphenyl.** F. M. Clark, Pittsfield, Mass., assignor to General Electric Co., a corporation of N. Y.

2,410,737. **Composition Including a Methyl Polysiloxane Resin Containing an Average of 1.3 to 1.7 Methyl Groups per Silicon Atom, from 5% to 90% by Weight of Lead Monoxide Based on the Resin, and as a Filler Magnesium Titanate.** A. L. Jenny, Pittsfield, Mass., assignor to General Electric Co., a corporation of N. Y.

2,410,775. **Color-Stabilized Resin Consisting of a Polymer of a Vinyl Halide and Another Polymerizable Mono-Olefinic Compound, and Including a Compound of the Group Amino-Guanidine and Salts of Amino-Guanidine.** F. W. Cox, Cuyahoga Falls, and J. M. Wallace, Jr., assignors to Wingfoot Corp., both of Akron, both in O.

2,410,779. **Removing a Polymerization Inhibiter from a Normally Gaseous Monomeric Substance by Treatment with a High-Boiling Solvent for the Inhibiter.** A. J. Gracia, Cuyahoga Falls, assignor to Wingfoot Corp., Akron, both in O.

2,410,780. **Treating Guayule Rubber by Heating It in a Dilute Aqueous Solution of Caustic Soda at a Temperature of about 150° C.** A. J. Gracia, Cuyahoga Falls, assignor to Wingfoot Corp., Akron, both in O.

2,410,781. **Treating Guayule Rubber by Heating It in a Dilute Aqueous Caustic Soda Solution at a Temperature of about 150° C. and Then Subjecting It to Solvent Treatment to Extract Residual Resinous Matter.** A. J. Gracia, Cuyahoga Falls, and H. V. Powers, Talmadge, assignors to Wingfoot Corp., Akron, all in O.

2,410,782. **Preserving Rubber by Incorporation of an Amide of an N-Arvl Amino Aryloxy Acetic Acid.** A. F. Hardmand, assignor to Wingfoot Corp., both of Akron, O.

2,410,783. **N-(p-Hydroxyaryl) Pyrroles.** A. F. Hardman, assignor to Wingfoot Corp., both in Akron, O.

2,410,788-789. **Fatty Amide Polymers.** W. L. Morgan, Columbus, O., and F. D. McLeod, Rumford, assignors to Arnold Hoffman & Co., Inc., Providence, both in R. I.

2,410,797. **For a Core of Textile Material, a Coating Including a Mixture of Synthetic Rubber Latex Solids, a Protein, and a Member of the Group of Aromatic Hydroxy Compounds and Their Salts.** T. R. Ten Broeck, Cuyahoga Falls, assignor to Wingfoot Corp., Akron, both in O.

2,410,830. **Subjecting Succinonitrile Vapor to Pyrolysis at a Temperature of 300 to 700° C. in the Presence of a Catalyst Including an Alkali Metal Cyanide on a Solid Support, to Produce Vinyl Cyanide.** C. R. Harris, Lockport, N. Y., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,410,839. **Separating Paraffinic Hydrocarbons from Solvent Extracts of Petroleum and from Vulcanizable Unsaturated Hydrocarbon Products Obtained from Petroleum Refining Residues.** F. S. Rostler, V. M. Wilson, and H. I. du Pont, assignors to Wilmington Chemical Corp., all of Wilmington, Del.

2,411,025. **Separating Butadiene from Hydrocarbon Mixtures Containing It and Monoolefins.** C. A. Coghlan, Beacon, assignor to Texas Co., New York both in N. Y.

2,411,029. **Subresinous Polyesters.** M. De Groote, University City, and B. Keiser, Webster Groves, both in Mo., assignors to Petrolite Corp., Ltd., Wilmington, Del.

2,411,033. **Coagulating Castilloa Latex by Treating with Dilute NaOH and Then with an Acid Substance to Neutralize the NaOH and to Coagulate the Rubber and Heating to Facilitate the Coagulation of the Rubber.** T. F. Ford, Arlington, Va., assignor to United States of America, as represented by the Secretary of Agriculture.

2,411,106. **Recovering a Concentrated Styrene Fraction from a Mixture thereof Primarily with Ethyl Benzene.** T. A. Petry, Wenonah, and G. L. Payne, Clarksboro, both in N. J., assignors to Socony-Vacuum Oil Co., Inc., a corporation of N. Y.

2,411,142. **Synthetic Fusible Amine Resins.** C. D. Kelso, Crete, Ill., and C. E. Adams, Highland, Ind., assignors to Standard Oil Co., Chicago, Ill.

2,411,219. **Reaction Products of Alpha-Beta, Dihaloether with a Member of the Group of Ammonium and Alkali Metal Salts of Dithiocarbamic Acid.** R. A. Mathes, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,411,225. **3,4-Dibromotetrahydrothiophene.** W. I. Patterson, Chagrin Falls, and J. V. Karabinos, Columbus, both in O., assignors, by mesne assignments, to Wyeth, Inc., Philadelphia, Pa.

2,411,236. **Contacting Paraffinic Hydrocarbon Gases with Sulfur Vapors at a Temperature of at Least 400° C. in the Presence of a Catalyst from the Group of Performed Metal Sulfides to Form Mercaptans.** C. M. Thacker, Highland Park, assignor to Pure Oil Co., Chicago, both in Ill.

2,411,237. **For Adhesive Sheets Having the Ability to Withstand Sterilizing Temperatures, a Coating Including a Polymerized Reaction Product of a Terpene with a Maleic Anhydride and a Polyhydric Alcohol, and an Additional Material Including Mostly Filler.** G. T. Turner, New York, N. Y., and E. P. Wenzelberger, Plainfield, N. J., assignors to Johnson & Johnson, a corporation of N. J.

2,411,256. **Making Butadiene from Ethylene and Acetylene.** F. E. Frey, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Del.

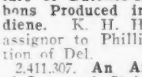
2,411,264. **Separating Butenes-2 from a Mixture of Butenes-2, C$_4$, and Heavier Hydrocarbons Produced in the Manufacture of Butadiene.** K. H. Hachmuth, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Del.

2,411,307. **An Aromatic Hydrocarbon Amine of Improved Stability Containing Finely Distributed 2,4-Dimethyl-6-Tertiary Butyl Phenol in Amounts of 0.01 to 1% Calculated on the Amine.** E. L. Waters, assignor to Shell Development Co., both of San Francisco, Calif.

2,411,346. **Refining Nitriles of the Class of Propionitrile, Normal Butyronitrile and Iso-Butyronitrile, by Subjecting Them to Fractional Distillation in Admixture with Acetonitrile and Distilling off Hydrocarbon Impurities and Acetonitrile as an Azeotrope.** J. W. Teter and W. J. Merwin, both of Chicago, Ill., assignors to Sinclair Refining Co., New York, N. Y.

2,411,396-397. **Sodium Cyanamide - Formaldehyde Condensation Products.** J. F. Walker, Lewiston, N. Y., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,411,413. **As a Vulcanization Accelerator, the Resinous Product Obtained by Fusing 2-8 Mols of a Para-Formaldehyde and 2-8 Mols of Mercaptobenzothiazole with One Mol of the Reaction Product of 1-2 Mols of Zinc Chloride and One Mol of the Guanidine Having the Formula**



in Which R Is an Aryl Radical. E. W. Cook, New York, N. Y., and E. O. Hook, Norwalk, Conn., assignors to American Cyanamid Co., New York, N. Y.

2,411,427. **Vulcanizing Rubber in the Presence of 1-(p-Hydroxyphenylamino-Methylene)-Beta-Naphthol.** A. F. Hardman assignor to Wingfoot Corp., both of Akron, O.

2,411,470. **Composition Made from Exfoliated Vermiculite and a Volatile Liquid Vehicle Containing a Thermoplastic Resinous Material.** T. P. G. Shaw, Shawinigan Falls, Quebec, assignor to Shawinigan Chemicals, Ltd., Montreal, both in P. Q., Canada.

2,411,474. **Improved Hydrolyzed Ethylene Vinyl Organic Ester Interpolymer.** H. B. Stevenson, Brandywine Hundred, assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, both in Del.

Dominion of Canada

437,302. **Water-Insoluble, but Petroleum-Soluble Composition with Corrosion-Inhibiting Properties, Consisting Essentially of Amino Derivatives of a Mixture of Different Saturated Aliphatic Ketones.** Alox Corp., New York, assignee of A. W. Burwell, Niagara Falls, both in N. Y., and J. A. Camelford, Cleveland, O., both in the U.S.A.

437,338. **For an Adhesive Sheet or Tape, a Pressure-Sensitive Eucohesive Adhesive Coating Including the Product Obtained by Heating Together Pasty Tacky Rubber and Sufficient Oil-Soluble Heat-Reactive Phenol-Aldehyde Resin to Render the Product Non-Thermoplastic and More Cohesive Than Adhesive, but Still Tacky.** Minnesota Mining & Mfg. Co., St. Paul, assignee of C. J. Ebel, West St. Paul, both in Minn., U.S.A.

437,459. **Shaped Articles Made from a Solution of Carboxylic Acid Ester of Cellulose and an Alkylated Glycol Ester of Methacrylic Acid Capable of Polymerization in a Volatile Solvent in the Absence of Plasticizer.** C. Dreyfus, New York, N. Y., assignee of J. E. Bludworth, Cumberland, Md., U.S.A.

437,483. **Solution of a Resinous Intercondensation Product Prepared by Condensing Dimethylol Urea with Methylol Ketone in the Presence of an Acidic Catalyst and a Lower Aliphatic Monohydric Alcohol.** Canadian Industries, Ltd., Montreal, P. Q., assignee of W. Nebel, Parlin, N. J., U.S.A.

437,487. **Normally Solid Hydroxyl Group-Containing Polymers Obtained by Reacting a Formaldehyde with a Monoolefin from the Group of Ethylene, Propylene, and the Isobutylenes in the Presence of a Per-Oxy Compound Catalyst.** Canadian Industries, Ltd., Wilmington, P. Q., assignee of W. E. Hanford, Wilmington, Del., U.S.A.

437,489. **For a Water-Soluble Polyvinyl Alcohol Film, a Water-Insoluble, Heat-Sealable Coating Including a Solution of a Water-Insoluble, Polyvinyl Acetal Resin, an Aliphatic Aldehyde, and an Acid Catalyst in a Volatile Organic Solvent.** Canadian Industries, Ltd., Montreal, P. Q., assignee of W. J. Jebens, Plainfield, N. J., U.S.A.

437,490. **Compound Sheet Material Including at Least Two Sheets of Base Material, at Least One Layer of Gelatinized Polyvinyl Chloride Composition on One of the Surfaces of the Base Materials, and at Least One Layer of a Composition Including a Polymerized Unsaturated Compound That Can Be Rendered Plastic at a Lower Temperature Than Polyvinyl Chloride.** Canadian Industries, Ltd., Montreal, P. Q., assignee of J. H. McGill, Manchester, England.

437,491. **As a Preservative for Rubber, a Mixture of 4-Hydroxy-3-(N-Piperidinomethyl)-Diphenylamine, and N-Phenyl-Beta-Naphthylamine.** Canadian Industries, Ltd., Montreal, P. Q., assignee of A. M. Neal and J. R. Vincent, both of Wilmington, Del., U.S.A.

437,496. **As Vulcanization Accelerator, an N-Substituted Thiocarbamyl Sulphamine.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of R. S. Hanslick, Stamford, Conn., U.S.A.

437,574. **Cellulose Films of Improved Water-Resistance Obtained by Impregnation with an Aqueous Colloidal Solution of a Cationic Aminotriazine - Aldehyde Condensation Product.** American Cyanamid Co., New York, N. Y., assignee of J. D. Pollard, Stamford, Conn., both in the U.S.A.

437,766. **Fusible, Heat - Convertible, Partial Polymer of Coreacted Divinyl Benzene and Carbon Tetrachloride Obtained by Reacting under Heat a Mixture of Divinyl Benzene in Diethyl Benzene and Carbon Tetrachloride.** Canadian General Electric Co., Ltd., Toronto, Ontario, assignee of G. F. D'Alelio, Pittsfield, Mass., U.S.A.

437,767. **Composition Including a Heat-Convertible Fusible Partial Copolymer of Divinyl Benzene and Diallyl Ether.** Canadian General Electric Co., Ltd., Toronto, Ont., assignee of G. F. D'Alelio, Pittsfield, Mass., U.S.A.

437,810. **Rigid Abrasive Body in Which the Bonding Agent Is the Condensation Product of a Mixture of Aniline, Triazine from the Group of Melamine and Diamino Triazine, and Formaldehyde.** Norton Co., Worcester, assignee of S. S. Kistler, West Boylston, both in Mass., U.S.A.

437,833. **Preparation of Alpha, Beta-Dihalo-Aliphatic Carboxylic Acids, Which Includes Halogenating a Nitrile of the Acrylic Series in an Acidic Medium.** Wingfoot Corp., assignee of J. D. Dianni, both of Akron, O., U.S.A.

United Kingdom

851,089. **Vulcanizable Compositions.** H. W. K. Jennings. (Wilmington Chemical Corp.)

581,099. **Preservation of Rubber and the Like.** Imperial Chemical Industries, Ltd.

581,127. **Water-Soluble Condensation Products.** Distillers Co., Ltd., J. D. Morgan, and B. Frenkel.

581,136. **Regeneration of Vulcanized Natural and Synthetic Rubbers.** R. B. F. F. Clarke and Imperial Chemical Industries, Ltd.

581,137. **Bonding Cured Olefin-Polysulfides and Related Sulfur-Containing Plastics.** W. J. S. Naunton, W. E. Roberts, J. T. Watts, and Imperial Chemical Industries, Ltd.

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— SALES REPRESENTATIVES —
Eastern BLACK ROCK MFG. CO. Bridgeport, Conn.
Western H. M. ROYAL Los Angeles, Calif.

581,141. **Plasticization of Synthetic Rubber-Like Materials.** Dunlop Rubber Co., Ltd., and P. H. Amphlett.

581,143. **Curing Polymeric Materials.** J. M. Buist, D. A. Harper, W. F. Smith, G. N. Welding, and Imperial Chemical Industries, Ltd.

581,144. **Curing Polymeric Organic Materials.** W. Furness, L. E. Perrins, W. F. Smith, and Imperial Chemical Industries, Ltd.

581,146. **Curing Polymeric Materials.** D. H. Coffey, W. F. Smith, H. G. White, and Imperial Chemical Industries, Ltd.

581,170. **Copolymers.** Pittsburgh Plate Glass Co. and E. J. Cleveland. (Pittsburgh Plate Glass Co.)

581,185. **Continuous Recovery of Unpolymerized Monomers from Butadiene Copolymers.** Wingfoot Corp.

581,224. **Bonding of Synthetic Resins.** Hall & Hall, Ltd., and H. E. Sampson.

581,254. **Organic Fluorine Compounds.** Imperial Chemical Industries, Ltd.

581,279. **Derivatives for Polymers and Interpolymers of Ethylene.** D. Whittaker, J. S. A. Forsyth, and Imperial Chemical Industries, Ltd.

581,280. **Polymerization of Methacrylic Acid Esters.** Imperial Chemical Industries, Ltd.

581,281. **Polymerization of Vinyl Esters of Organic Acids.** Imperial Chemical Industries, Ltd.

581,300. **Cellular Rubber.** United States Rubber Co.

581,313. **Plasticizing Fabrics and Production of Laminated Fabrics therefrom.** British Celanese, Ltd.

581,339. **Condensation Products.** Soc. of Chemical Industry in Basle.

581,343. **Polymeric Material from Butadiene or Its Homologs.** D. B. Kelly and Imperial Chemical Industries, Ltd.

581,368. **Thermoplastic Materials.** Semtes, Ltd., F. G. Mottershaw, L. H. Griffiths, and W. Saul.

581,387. **Polyvinyl Alcohol Films and Sheets of Reduced Water-Sensitivity.** E. I. du Pont de Nemours & Co., Inc.

581,410. **Curing Polymeric Materials.** D. A. Harper, W. F. Smith, and Imperial Chemical Industries, Ltd.

581,421. **Water-Sensitive Non-Fibrous Sheet-Like or Film-Like Materials.** British Cellophane, Ltd.

581,431. **Chlorinated Derivatives of Ethyl Alcohol.** E. I. du Pont de Nemours & Co., Inc.

581,439. **Curing Polymeric Materials.** D. A. Harper, W. F. Smith, and Imperial Chemical Industries, Ltd.

581,484. **Polymerization Process.** Distillers Co., Ltd., J. J. P. Staudinger, M. D. Cooke, and D. A. Bennett.

581,501. **Vinyl Esters.** Imperial Chemical Industries, Ltd.

581,525. **Compositions for Adhesive or Sealing Purposes.** B. B. Chemical Co., L. E. Puddefoot, W. H. Swire, and A. D. Woods.

581,539. **Mono-Amino-Ethyl Sulfuric Acid Ester.** Carbide & Carbon Chemicals Corp.

581,573. **Vinyl Halides.** Wingfoot Corp.

581,589. **Reclaiming Vulcanized Synthetic Rubber Scrap.** J. Obloczynski and North British Rubber Co., Ltd.

581,616. **Bonding Viscose Rayon Filaments to Rubber.** Courtaulds, Ltd., and D. Entwistle.

581,627. **Vinyl and Ethylidene Esters.** E. I. du Pont de Nemours & Co., Inc.

581,628. **Fluorine Containing- Organic Compounds.** E. I. du Pont de Nemours & Co., Inc.

581,662. **Organic Fluorine Compounds.** E. I. du Pont de Nemours & Co., Inc.

581,702. **Thermosetting Resins.** British Industrial Plastics, Ltd., and A. Brookes.

581,717. **Polythene Films** J. R. Myles, D. Whittaker, and Imperial Chemical Industries, Ltd.

581,751. **Coating Solid Organic Polymers with Polysilicic Acid Esters.** E. I. du Pont de Nemours & Co., Inc.

581,775. **Abnormal Addition of a Hydrogen Halide, Hydrogen Sulfide, or a Mercaptan.** Shell Development Co.

MACHINERY

United States

2,409,725. **Apparatus for Automatic Molding of Plastics.** J. B. Whitmore, Bloomfield, W. Makenny, Mountain View, and F. A. Newcombe, Nutley, all in N. J., assignors to Westinghouse Electric Corp., East Pittsburgh, Pa.

2,409,974. **Apparatus for Building Pneumatic Tire Casings.** W. J. Breth and R. M. Wormald, assignors to General Tire & Rubber Co., all of Akron, O.

2,410,324. **Machine for Molding Thermosetting Materials.** R. H. Windsor and E. Gaspar, London, England; Gaspar assignor to Windsor.

2,410,510. **Apparatus for Molding Heat Plasticizable Material.** N. Lester, Cleveland Heights, assignor to Lester Engineering Co., Cleveland, both in O.

2,410,905. **Device to Cut Lateral Slits in an Endless Flexible Band.** F. Slusher, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,411,254. **Apparatus for Molding Thermosetting Material.** G. H. Frank, Oak Park, Ill., assignor to Western Electric Co., Inc., New York, N. Y.

Dominion of Canada

437,406. **Machine for Bias-Cutting and Splicing Tire Fabric.** W. J. Perry, Toronto, Ont.

437,739. **Apparatus for Concentration of Liquid, Such as Latex or the Like, by Evaporation under Vacuum.** K. H. Quasebarth, Kew Gardens, N. Y., U.S.A.

United Kingdom

581,459. **Tire Retreader.** S. A. Wright

581,605-606. **Extrusion Heads for Injection Molding Apparatus.** E. Aron and E. Pollard.

581,637. **Extrusion Heads for Extrusion Molding and Injection Molding Apparatus.** E. Aron and E. Pollard.

581,642. **Apparatus for Injection Molding of Plastics.** H. G. W. C. Miles.

UNCLASSIFIED

United States

2,409,666. **Bead Clamp for Pneumatic Tires.** F. H. Comey, assignor to General Tire & Rubber Co., both of Akron, O.

2,409,753. **Valve for Hose Couplings.** J. H. Harrison, Palos Verdes Estates, and H. E. Byers, Los Angeles, both in Calif.

2,410,573. **Wheel and Rim Organization for Wheels Equipped with Heavy-Duty Pneumatic Tires.** C. L. Eksergian, Detroit, Mich., assignor to Budd Co., Philadelphia, Pa.

2,410,600. **Flexible Conduit and Coupling Tires.** C. L. Eksergian, Detroit, Mich., assignor of 70% to himself and 30% to R. W. Lotz, Chicago, Ill.

2,411,057. **Hose Coupling.** J. .S. Robbins, Highland Park, Ill.

2,411,285. **Low-Pressure Alarm System for a Pneumatic Tire.** R. G. Miller, Milwaukee, Oreg.

Dominion of Canada

437,834. **Rim for Mounting a Straight-Sided Pneumatic Tire of the Extensible Open-Beaded Type.** Wingfoot Corp., assignee of F. S. Riggs, both of Akron, O., U.S.A.

United Kingdom

581,180. **Hose Connections.** Dunlop Rubber Co., Ltd., and H. W. Trevaskis.

581,204. **Hose Couplings.** Dunlop Rubber Co., Ltd., and H. W. Trevaskis.

581,263. **Joints for Electric Cables.** W. T. Henley's Telegraph Works Co., Ltd., and J. I. King.

581,438. **Operation of Brakes for Aircraft Wheels Having Retractable Supports.** Dunlop Rubber Co., Ltd., and H. W. Trevaskis.

581,551. **Terminating Electric Cables.** Okonite-Callender Cable Co., Inc.

581,552. **Electric Cable Joint.** R. B. Canning.

581,553. **Tire Removing Tools.** Firestone Tire & Rubber Co.

TRADE MARKS

United States

424,021. **Texlock.** Cushioning supports and furniture fillers. Sponge Rubber Products Co., Shelton, Conn.

424,026. **Cellotron.** Adhesive tape dispensers. Freydberg Bros.-Strauss, Inc., New York, N. Y.

424,027. **Cellomat.** Adhesive tape dispensers. Freydberg Bros.-Strauss, Inc., New York, N. Y.

424,039. The word: **"Warren's"** above a representation of three oak trees. Elestic. Warren Featherbone Co., Three Oaks, Mich.

424,044. **Peel Film.** Plastic coating. Nox-Rust Corp., Chicago, Ill.

424,054. Representation of an oval containing the word: **"Gates."** Tires, tubes, belts, hose. Gates Rubber Co., Denver, Colo.

424,062. The word: **"Wirenuts"** with the representation of a glass with the word: "Ideal" covering one of the letters. Insulation. Ideal Commutator Dresser Co., Sycamore, Ill.

424,085. **Kolber.** Fountain pen parts. A. Kolber, Inc., New York, N. Y.

424,101. **Fosterite.** Insulation. Westinghouse Electric Corp., East Pittsburgh, Pa.

424,244. Representation of a circle cut by lightning. Golf balls and clubs. Sporting Goods, Inc., Springfield, Mass.

424,255. **Full-Freedom.** Corsets, brassieres, etc. La Resista Corset Co., Bridgeport, Conn.

424,265. **Cambridge Junior.** Rainwear. I. J. Rubin, New York, N. Y.

424,295. **Craig Wood. Rainwear.** Sport Products, Inc., Cincinnati, O.

424,316. **Cressa.** Hand cleaner for removing rubber soil and compounds. R. T. Bradley, doing business as Pawl-Rae Products Co., South Bend, Ind.

424,325. Representation of a circle with a smaller circle inside with the word: **"Victory"** and two stars on it. Synthetic rubber mark remover. Victory Soap & Chemical Co., Inc., New York, N. Y.

424,347. **Kendex.** Thermoplastic resins. Kendell Refining Co., Bradford, Pa.

424,348. **Vyram.** Synthetic resins. Monsanto Chemical Co., St. Louis, Mo.

424,360. **Victocel.** Plastic in sheet form. Celluplastic Corp., Newark, N. J.

424,374. Representation of an oval containing the word: **"Sani-Mode."** Shower curtains. Sani-Mode Mfg. Co., Chicago, Ill.

424,383. **Lus Koat.** Rainwear. Irving Lusk, Inc., New York, N. Y.

424,395. **Vita-guard.** Shower and window curtains. A. L. Seigal Co., Inc., New York, N. Y.

424,401. **Helicopter.** Rainwear. Rapid Sportswear Co., New York, N. Y.

424,424. **Steel-Flex.** Sectional air bags for tire repairing. Firestone Tire & Rubber Co., Akron, O.

424,455. **Quality 108.** Coated fabrics. Eggers Fabric Co., New York, N. Y.

424,456. **Superteen.** Coated fabrics. Eggers Fabric Co., New York, N. Y.

424,457. A fanciful design of circular and slanting thin lines. Artificial leather. Textileather Corp., Toledo, O.

424,468. Representation of an oblong containing the word: **"Kumbak."** Electrical cords. Kellogg Switchboard & Supply Co., Chicago, Ill.

424,530. Representation of an oblong containing the word: **"Expandex."** Electrical cords. Kellogg Switchboard & Supply Co., Chicago, Ill.

424,531. Representation of an oblong containing the word: **"Recoilo."** Electrical cords. Kellogg Switchboard & Supply Co., Chicago, Ill.

424,574. **Statler Merchandise Company.** Synthetic plastics. Statler Merchandise Co., assignor to Statler Mfg. Co., both of Chicago, Ill.

424,588. Representation of a shield containing the words: **"Phillips 66."** Gasket cement. Phillips Petroleum Co., Bartlesville, Okla.

424,609. **Injex.** Fountain pens and fillers. Bol, Ltd., New York, N. Y.

424,621. **Parafilm.** Shower curtains. Para Mfg. Co., Inc., Newark, N. J.

424,639. **Sunoco.** Tire and tube repair kits. Sun Oil Co., Philadelphia, Pa.

424,672. **"All-Size."** Merchandise tubing. Traver Corp., Chicago, Ill.

424,694. Representation of a shield containing the words: **"Phillips 66."** Tire coating or dressing. Phillips Petroleum Co., Bartlesville, Okla.

424,734. **Pepton.** Plasticizer. American Cyanamid & Chemical Corp., New York, N. Y.

424,742. **Hamiseal.** Dispersed synthetic rubber. Haas-Miller Corp., Philadelphia, Pa.

424,795. Representation of a triple circle with the letter **"K."** Submersion actuators for actuating valves for the release of gas under pressure from containers to inflate bags which form buoyant floats for supporting disabled aircraft. Walter Kidde & Co., New York, N. Y.

424,841. Representation of a shield containing the words: **"Phillips 66."** Battery cables and storage batteries. Phillips Petroleum Co., Bartlesville, Okla.

424,847. **"Silent Pro".** Golf balls, bags, and club wrist band grips. A. J. Wyman, Orange, N. J.

424,866. **Val-Keen.** Storage batteries. Oakes & Co., doing business as Tru-Test, Chicago, Ill.

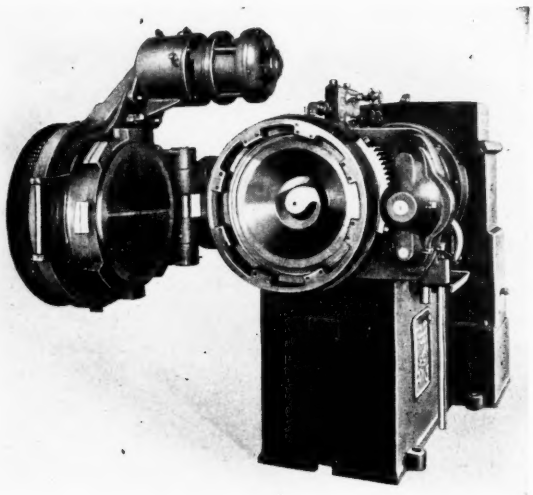
424,871. **Blackhawk.** Tire rim wrenches. Blackhawk Mfg. Co., Milwaukee, Wis.

424,884. **-Claroco-.** Portable dust collectors. J. S. Clark Co., Detroit, Mich.

424,888. **Dayco.** Conveyer belts. Dayton Rubber Mfg. Co., Dayton, O.

424,904. **Bunalite.** Coated cotton fabric. Belgrade Fabrics, Inc., New York, N. Y.

424,920. **Plastron.** Bags. Plastron, Inc., New York, N. Y.



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An easy, rapid flow of stock with but little rise in temperature. . . .

Less time lost in cleaning and changing screens. . . .

These are among the features which make the choice of a Royle Strainer a profitable investment. . . .

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PATERSON 3, NEW JERSEY

Important Announcement

REGARDING THE MONTHLY

Rubber Statistical Bulletin

Containing Complete Information Regarding Quotas, Production, Absorption, Stocks, and Prices.

Beginning with the January, 1947, issue INDIA RUBBER WORLD will cease to operate as authorized distributers for the U. S. A., and all orders and remittances should be sent direct to London headquarters from which mailings will be made. This move was necessitated by the fact that bulk packages for distribution here were slow in transit and reached the United States several weeks after single copies sent direct. It will mean quicker service to subscribers. After the December, 1946, issue all subscribers will be serviced from London and will receive proper credit of unexpired portions of their subscriptions.

ALL FUTURE ORDERS SHOULD BE ADDRESSED TO:

LONDON RUBBER SECRETARIAT

Brettenham House, 5-6 Lancaster Place, London, W.C.2, England

$5.00 PER YEAR—50 CENTS PER SINGLE COPY

424,925. **"Weld-Rite."** Tire repair materials. B. F. Goodrich Co., New York, N. Y.

424,926. **UsCap.** Tire retread rubber. U. S. Rubber Co., New York, N. Y.

424,930. **Parchlined.** Waterproof bags. Bemis Bro. Bag Co., St. Louis, Mo.

424,941. Representation of an arrow through the word: **"Airtron."** Prefabricated duct sections. Arrowhead Rubber Co., Vernon, Calif.

424,948. **Irv-O-Flatseme.** Cambric insulating tape. Irvington Varnish & Insulating Co., Irvington, N. J.

424,952. Representation of a planet and the word: **"Stratosphere."** Footwear. Moncey Products Corp., Chicago, Ill.

424,968. **Aliv.** Footwear. Titan Safety Shoe Co., Spencer, Mass.

425,002. Representation of an oblong with the word: **"Extendo."** Electrical cords. Kellogg Switchboard & Supply Co., Chicago, Ill.

425,002. Representation of an oblong with the word: **"Autoflex."** Electrical cords. Kellogg Switchboard & Supply Co., Chicago, Ill.

425,025. **Buskens.** Footwear. Cortell Shoe Co., Manchester, N. H.

425,031. **The Line Of Youth.** Corsets, girdles, etc. La Resista Corset Co., Bridgeport, Conn.

425,056. **Toni Gay.** Footwear. British West Indies Co., New York, N. Y.

425,057. **Olathie Cowboy.** Footwear. C. H. Hyer & Sons, Olathe, Kans.

425,063. Representation of a shield with the letter: **"K"** between the words: **"Glenn Shoes."** Footwear. B. A. Corbin & Son Co., Marlborough, Mass.

425,064. **Real Form.** Suspenders, arm bands, garter and trouser belts. Globe Novelty House, New York, N. Y.

425,088. **Winnebago.** Vinyl-type plastic sheeting. Crest Fabrics Corp., New York, N. Y.

425,092. **Barbara Lee, Jr.** Girdles, garter belts, etc. Associated Merchandising Corp., New York, N. Y.

425,103. **Target.** Hose. Lee Rubber & Tire Corp., Youngstown, O.

425,145. **Circosol.** Plasticizer. Sun Oil Co., Philadelphia, Pa.

425,245. **Crystalite.** Shower caps, rainwear, baby pants, etc. S. V. Boland, doing business as Boland Mfg. Co., Chicago, Ill.

425,249. Representation of a seal containing the words: **"Visking Product"** and the letters: **"VTS"** over a representation of a playing card king. Monofilaments and copolymers of vinylidene chloride. Visking Corp., Chicago, Ill.

425,290. **Gates Flexcord.** Belts and hose. Gates Rubber Co., Denver, Colo.

425,295. **Sovran.** Girdles. Freeman Mfg. Co., Sturgis, Mich.

425,300. **Protecote.** Moistureproofed packaging. Standard Cap & Seal Corp., Brooklyn, N. Y.

425,361. **Scotch-Rap.** Wrapping sheet. Minnesota Mining & Mfg. Co., St. Paul, Minn.

425,419. **Korker.** Printing press blankets. Tingue, Brown & Co., New York, N. Y.

425,451. **Lyk-Nu.** White tire coating. A. A. Banks, doing business as Lyk-Nu Co., New York, N. Y.

Foreign Trade Opportunities

The firms and individuals listed below have recently expressed their interest in buying in the United States or in United States representations. Additional information concerning each import or export opportunity, including a World Trade Directory Report, is available to qualified United States firms and may be obtained upon inquiry from the Commercial Intelligence Unit of the United States Department of Commerce, or through its field offices, for $1 each. Interested United States companies should correspond directly with the concerns listed concerning any projected business arrangements.

Export Opportunities

Leslie M. Marks, 326 Flinders St., Melbourne, Australia: fountain pens and pencils, electrical appliances, toys and games, rubber shoes.

Hugo Frei S. P. R. L., 50-56 Rue de la Sambre, Antwerp, Belgium: gums.

Canadawide Sales Co., Ltd., 201 Church St., Toronto, Ont., Canada: sporting goods and athletic equipment.

Industrias de la Goma S. A., Quilpue, Chile: rubber working machinery and raw materials for a rubber factory.

Maurice Kibrit, representing Victor Toriel & Co., 1 Rue Toriel, Alexandria, Egypt. automobile, motorboat, and airplane parts and accessories, industrial chemicals, plastic manufactures.

Rubens de Souza, representing Autobras Ltda., Avenida Rio Branco 277-B, Rio de Janeiro, Brazil: automobile tires and accessories.

Hygiene & Entretien, 99 Rue des Augustines, Jette-Brussels, Belgium: household, medical, and hospital rubber goods, combs.

L. F. Cuilty, representing "Mexpan," Despacho 806, San Juan de Letran 9, Mexico D. F., Mexico: automobile accessories, industrial chemicals, plastics.

Fung Keong Rubber Manufactory (Malaya), Ltd., Fung Bldg., High St., Kuala Lumpur, British Malaya; passenger-car and truck tire-cord fabrics, bicycle tire-cord fabric, lorry tire-cushion canvas, lorry tire-bead fabric, passenger-car tire-bead fabric; valves for inner tubes.

Umberto Zaghi, 34 Vio D'Azeglio, Bolgona, Italy: automotive accessories and supplies, tire casings, inner tubes, rubber washers, valves.

M. Paul Louis, of Etablissements Paul Louis, 49 Rue G. J. Martin, Voluwe, Belgium: druggists' sundries, hospital supplies, and rubber goods for drug sales.

Brasserie Royale de Laeken, 184 Chaussee d'Anvers, Brussels, Belgium: brewers' rubber hose.

Arpic, N. V., 60 Overtoom, Amsterdam, W., Netherlands: automotive spare parts and accessories.

M. Spijer, 28 Huygenspark, The Hague, Netherlands: toys and dolls.

Soc. Acc. "Horvat," 24 r Via del Giglio, Florence, Italy: rubber toys and games.

Juan H. Darquea, Montalvo No. 811, Ambato, Ecuador: tires, electrical equipment, plastic products, cotton and rayon fabrics.

Guido W. Steinvorth, representing "Sacco," S. A. de Crédito y Comercio, Cuji a Salvador de Leon 3, Caracas, Venezuela: automotive parts and accessories, textiles, notions.

Anam Tools Import, 39 Niewe Heerengracht, Amsterdam, C. Netherlands: automobile accessories.

Malayan Rubber Statistics

The following statistics have been received from Singapore by way of Malaya House, 57 Trafalgar Square, London, W.C.2, England.

Ocean Shipments from Singapore and Malayan Union—In Tons

	October, 1946	
To	Sheet and Crepe	Latex, Concentrated Latex, Revertex (Dry Rubber Content)
Argentine Republic	415	....
Australia	2,288	....
China	739	....
Cuba	75	....
Finland	145	....
Hong Kong	538	....
Mexico	1,820	....
New Zealand	69	....
Norway	30	....
Other Countries in South America	300	....
Sweden	1,130	....
Union of South Africa	1,900	....
United Kingdom	35,041	168
U. S. A.	32,982	489
TOTAL	77,472	657

Foreign Imports of Rubber in Long Tons

	October, 1946	
Singapore Imports From	Dry Rubber	Wet Rubber (Dry Weight)
Banka and Billiton	46	1
British North Borneo	461	2
Brunei	41	....
Dutch Borneo	553	61
French Indo-China	....	45
Java	47	....
Labuan	342	4
Other Dutch Islands	73	39
Rhio	585	16
Sarawak	2,385	43
Siam	15	....
Sumatra	7,318	3,870
TOTAL	11,866	4,081
Malayan Union Imports From		
Burma	1,006	329
Siam	78	....
Sumatra	1,027	33
TOTAL	2,111	362

Dealers' Stocks—October, 1946 (Dry Tons)

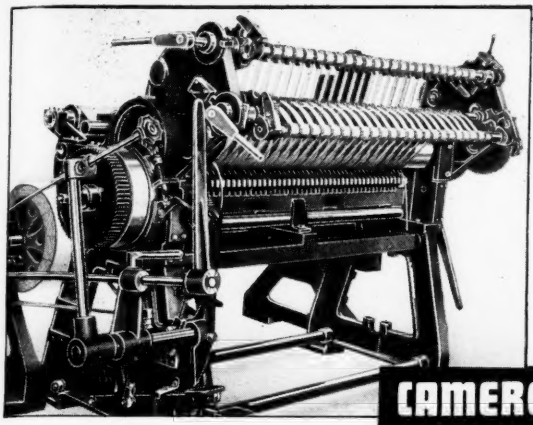
Dry Rubber	44,768
Wet Rubber (Estimated dry weight)	6,947
Latex	5
TOTAL ALL GRADES	51,720

Port Stocks—October, 1946

Harbor Board (Wharves and Lighters)	1,002
Malayan Railways	6,657
Other Port Stocks	5,431
TOTAL	13,090

Rims Approved and Branded by The Tire & Rim Association, Inc.

RIM SIZE	Nov., 1946
15" & 16" D. C. Passenger	
15x4.00E	30,817
16x4.00E	410,122
16x4.50E	285,690
15x5.00E	135,164
16x5.00F	10,364
15x5.50F	87,502
16x5.50F	4,823
16x4.00E—Hump	215,352
15x4.50E—Hump	58,098
16x4.50E—Hump	10,911
15x5.00F—Hump	148
15x3-K	41,066
16x3-K	90,960
15x6-L	19,989
16x6-L	99,559
15x6½-L	39,332
17" & Over Passenger	
18x2.15B	4,120
Flat Base Truck	
20x3.75P	2,401
17x4.33R	18,585
20x4.33R	53,752
20x5.00R	21,975
15x5.00S	3,319
17x5.0	7,844
18x5.0	6,813
18x5.00S	1,018
20x5.0	28,454
20x5.00S	291,064
20x6.00S	4,752
18x6.00T	235
20x6.0	124,512
20x6.00T	93,512
15x7.33V	644
18x7.0	1,021
18x7.33V	1,527
20x7.33V	30,716
22x7.33V	16,072
24x7.33V	3,991
19x8.37V	323
20x8.37V	4,663
24x8.37V	2,491
20x10.00W	1,439
24x10.00W	1,315
Semi D.C. Truck	
16x4.50E	5,425
15x5.50F	22,366
16x5.50F	6,755
Tractor & Implement	
12x2.50C	4,113
12x3.00D	8,590
15x3.00D	26,770
16x3.00D	9,536
19x3.00D	14,087
21x3.00D	2,559
20x4.50E	8,871
18x5.50F	4,871
36x6.00S	3,670
24x8.00T	1,510
28x8.00T	2,218
32x8.00T	257
36x8.00T	1,345
40x8.00T	658
W7-24	2,780
W8-24	4,665
W8-36	900
W8-38	268
W9-38	477
W10-24	1,998
W10-26	337
W10-28	2,097
W10-36	1,960
W10-38	3,157
W11-26	1,216
DW9-38	9,033
DW10-38	20,330
DW11-24	869
DW11-26	367
DW11-30	253
DW11-32	2,154
DW11-38	3,576
DW12-26	2,380
DW12-30	3,246
DW12-34	2,968
Earth Mover	
24x13.00	3
24x15.00	194
TOTAL	2,455,284



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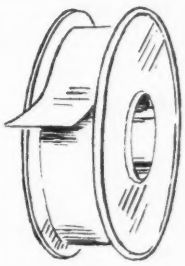
SPEEDS PRODUCTION OF SURGICAL ADHESIVE TAPE ON FLANGED ROLLS

Slits the full width of the web into measured strip, rolls the strips onto flanged spools, stops automatically at measured length, all in one operation.



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Stamford Neophax Vulcanized Oil

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Top-Quality that never varies!

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Do You Have a High Pressure Reducing Valve Problem?

Seldom do we find higher pressures in rubber plants than 6000 lb. per sq. in. Consequently this reducing valve, shown below, is the one we usually recommend. It handles working pressures up to 6000 lb., without shock—oil, water, or air—and it does so well that we are receiving repeat orders nearly every day from satisfied users. It is our

ATLAS Type "E"

Forged Steel Body. Internal metal parts entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure. Truly modern in every respect.

We make regulating valves for every rubber plant service. See partial list below.

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REGULATING VALVES FOR EVERY SERVICE

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Representatives in Principal Cities

☐ Please send complete information on Atlas High Pressure Reducing Valve. Also, please send information on the following Atlas products.

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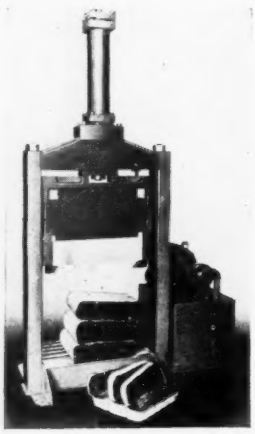
- ☐ Reducing Valves
- ☐ Exhaust Control Systems
- ☐ Pressure Regulators
- ☐ Pump Governors
- ☐ Float Valves
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves
- ☐ Oil Control Cocks

Write your name, firm, and address on the margin of this page, tear out with this ad., mail, and you will hear from us promptly.

CRUDE RUBBER BALE CUTTER



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Fully Assembled

Hydraulic Operation

High Production

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An efficient machine of simple design for cutting bales of crude, synthetic and reclaimed rubber or similar materials. Cuts without aid of water or other lubricant. One man operation—safety control.

•

SPADONE MACHINE COMPANY

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New Machines and Appliances

New Farrel-Birmingham Long Belt Vulcanizing Press

Improved Belt Vulcanizing Press

FOR cutting production costs in the manufacture of rubber-impregnated belt stock of various widths and gages, a new 60-inch by 31-foot platen press of new design and simplified construction, made by Farrel-Birmingham Co., Inc., Ansonia, Conn., offers the double advantage of improved operating efficiency and lower maintenance costs. Built for heavy duty, the press exerts a pressure of 280 p.s.i. on the platen area, or a total of about 3,100 tons, by means of eight 22-inch diameter rams operating under hydraulic pressure of 2,000 p.s.i.

The most important design innovation is in the construction of the top crosshead and reduced number of cylinders. Cast in two sections, each weighing 43,000 pounds, the crosshead permits wider center placement of the cylinders, which are larger and less than half in number of those required for a similar-type press with individual top crosshead for each cylinder. This simplified construction reduces upkeep, with a consequent reduction of maintenance items such as replacement of worn packing.

Equipment includes polished steel upper and lower platens, 3¼ inches thick, which are drilled for steam circulation. An edging device of new design, fitted to the bottom platen with its actuating mechanism outside the platen area, permits curing belts of approximately the full platen width. Another feature is the positive equalizing device connected with the follower crosshead, which keeps the bottom platen at a true level when the press is opening or closing.

To prevent endwise movement, the follower platen is secured at the center by guides located on one tie rod on each side.

FOR GOOD ABRASION RESISTANCE USE PHILBLACK A

FOR FURTHER DETAILS, SEE AD ON PAGE 458

RMP
ANTIMONY
FOR RED RUBBER

. . . . The utmost in pleasing appearance with no deteriorating effect whatever.

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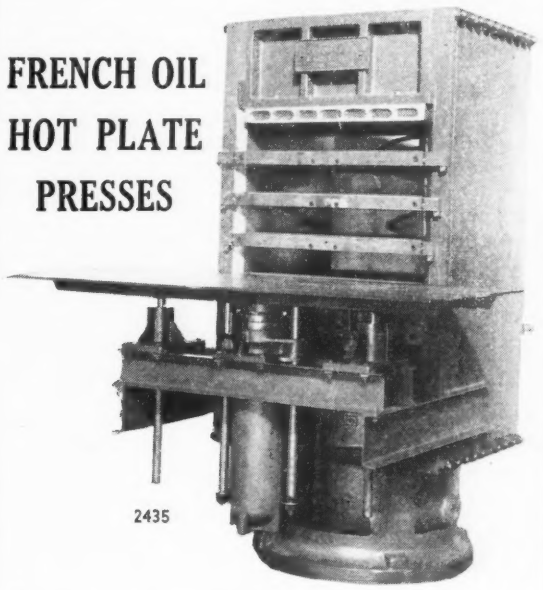
RARE METAL PRODUCTS CO.
ATGLEN, PA.

FRENCH OIL HOT PLATE PRESSES



Side plate or column presses for compression or transfer or injection molding of rubber and allied synthetics.

Write for bulletins on "Modern Hydraulic Presses."

The FRENCH OIL MILL MACHINERY CO.
PIQUA, OHIO

Wanted
ADHESIVE PROBLEMS

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- PLASTIC • LEATHER • FABRIC
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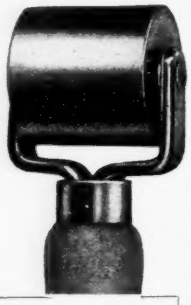
HOGGSON BRAND
Since 1849

Cementing & Vulcanizing Tools



HUNDREDS OF DESIGNS —

Scores of standard tools carried in stock for working rubber, leather, plastics, paper, cement, etc. Special tools made to your order. Also—steel letters, figures, stamps, dies and molds. Explain the job, we'll suggest the tool.

HOGGSON & PETTIS MFG. CO.
141S Brewery St., New Haven 11, Conn.

The term

"COTTON FLOCKS"

does not mean cotton fiber alone

EXPERIENCE
over twenty years catering to rubber manufacturers

CAPACITY
for large production and quick delivery

CONFIDENCE
of the entire rubber industry

KNOWLEDGE
of the industry's needs

QUALITY
acknowledged superior by all users are important and valuable considerations to the consumer.

Write to the country's leading makers for samples and prices.

CLAREMONT WASTE MFG. CO.

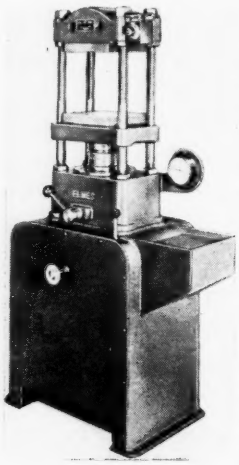
CLAREMONT N. H.

The Country's Leading Makers

Being held only at the center, the platen is free to expand in both directions. Other guides on a pair of tie rods near each end of the press prevent sidewise movement. The design of the stretcher and clamp unit allows the stretcher reaction load to be absorbed and balanced by the middle and the top members of the press structure.

To assure necessary strength and rigidity, the principal parts of the press, with the exception of the forged steel tie rods, are made of Mechanite. These include the top, bottom and moving crossheads which are proportioned for maximum deflection of 0.005-inch. The press is mounted on substantial stringer bedplates. Hydraulic piping is arranged for with one common connection, and all other details are planned for maximum operating convenience.

Pumpless, Motorless Press

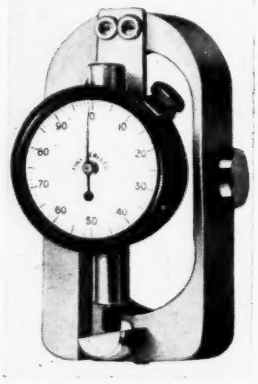


30-Ton Elmes Hydraulic Press Operating on Compressed Air

A COMPLETE new line of high-production, fully power-operated, hydraulic presses that have neither motor nor pump has been announced by Elmes Engineering Works. Compressed air from shop line, introduced above the liquid by a simplified control, provides the power for rapid closure and instantaneous full pressure. The control applies and maintains any desired pressure within capacity range and repeats at that pressure until reset.

This new hydraulic principle promises greater economies in the molding of plastics and rubber, in assembly forcing, straightening, and in testing. Simple design, negligible air requirements, as well as low first cost, operation, and maintenance, are combined in lightweight, compact press construction. The presses are made in 20- and 30-ton bench type and floor-type models and in a 50-ton floor-type. The 30-ton floor-type press illustrated has a six-inch stroke, and opening adjustable from 0 to 13 inches, and can be equipped with 10-by 10-inch hot plates. It is 65 inches high, has a shipping weight of 1,325 pounds, requires a 37-by 19-inch floor space, and has a shelf for operating tools.

New Pressure Gage



New Dillon Mechanical Pressure Gage

NOW available is a new pressure gage which can be used to check pressure between spot welding machine electrodes, between platen in all types of presses, and between moving rollers, and tension in a moving thread, twine, wire, etc. The new instrument has been purposely designed to be small in size so that it can fit into "tight" spots heretofore inaccessible, yet where pressures of static or moving parts must be measured.

The new gage is available at present in six pressure ranges: 0-100 pounds, 0-250 pounds, 0-500 pounds, 0-1,000 pounds, 0-2,500 pounds, and 0-5,000 pounds. A 10,000-pound capacity model will shortly be added to the line, making it even more complete. The gage is compact in size; the 0-100-pound model is 3⅝ inches long, 2-7/32 inches high and 1¾ inches wide, and weighs only 1¼ pounds net. The 0-250-pound, the 0-500-pound, and the 0-1,000-pound models are all 4-5/16 inches long, 2-7/16 inches high, and 2-5/16 inches wide, and weigh only 2 pounds net. The 0-2,500-pound and the 0-5,000-pound models are 4⅝ inches long, 2⅜ inches high, and 2¾ inches wide, and weigh only 2½ pounds net. All models

(Continued on page 583)

EUROPE

FRANCE

Study of Thioplasts

Since Katz first demonstrated the crystalline structure of stretched natural rubber by his X-ray investigations, the method has also been applied to the study of the structure of a number of linear polymers having a periodical formula. Katz himself, in collaboration with Fuller, was the first to study the thioplasts or polysulphide rubbers by means of X-ray in 1935, when a sample of stretched Thiokol was found to give an excellent fiber diagram, by means of which the investigators were able to calculate the identity period of the macromolecule and to suggest a solution for the basic crystalline network.

The rapid development in the manufacture of thioplasts that has since taken place led R. Tertain, of Compagnie de Produits Chimiques et Electrometallurgiques Alais Froges et Camargue, to undertake in 1944 and 1945 a new and profounder study of these products when not only the scientific, but also the technological and utilitarian aspects of the problem were considered.

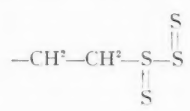
The author set forth the results he obtained in an article which on May 31, 1946, was awarded the Rubber Industry Prize for 1945 and recently appeared in the *Revue Générale du Caoutchouc*. The material is divided into three parts: (I) X-ray diffraction as method of identifying thioplasts and controlling their manufacture; (II) the Molecular structure of Thiogomme "S"; and (III) study of thiorubber vulcanizates and the mechanism of vulcanization.

In the first part the author shows how the dissimilar properties of different types of thioplasts or the variation of these properties by the kind of treatment to which the materials have been subjected can be distinguished and interpreted by their X-ray pictures.

A normal unstretched, rubbery flexible Thiogomme "S" (polymer of ethylene tetrasulfide) presents an entirely different picture from that of a stretched sample, or one that for some still obscure manufacturing reasons becomes hard and brittle in a matter of weeks, days, or even hours; or one that has been sheeted and peptized, or subjected to thermal treatment; or a sample of thiorubber formed from a thiolatex by evaporation, or of variously treated samples of Thiogomme "R."

Thiogomme "R," it is pointed out, is markedly different from Thiogomme "S"; it cannot be stretched in a cold state because it is normally hard and brittle; it must therefore first be slightly heated; however under a variety of conditions it has been found impossible to obtain from this thioplast crystalline orientation phenomena. It seems to have a more or less irregular non-periodic structure depending on the method of polycondensation.

In Part II the author discusses the structure of Thiogomme "S" and chiefly on the basis of the interpretation of its fiber diagram in accordance with the laws of radiocrystallography, suggests the following formula for this structure:



Such a structure, it seems, would help explain the process of extensibility in thiorubbers.

While the elasticity of natural rubber is generally explained by the coiling and uncoiling of long molecular chains in which the C=C double bonds play the part of pivots, says M. Tertian, this explanation does not fit the case of the thiorubbers, which have no double bonds in chain and yet are extensible. He suggests that the most important factor for elasticity may be intermolecular sliding, which alone accounts for marked deformations, and this, he adds, seems to agree with present observations, especially on the considerable residual thermoplasticity of even vulcanized thiorubbers, and the fact that much elongated samples always show a very marked permanent deformation.

Finally, in Part III M. Tertian gives a new explanation of zinc oxide vulcanization. There is here no intermolecular bridging as in natural rubber, that is by main valences, he

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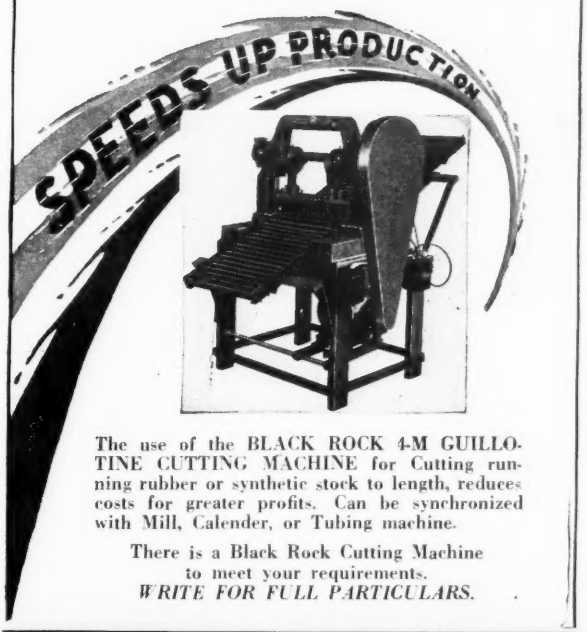

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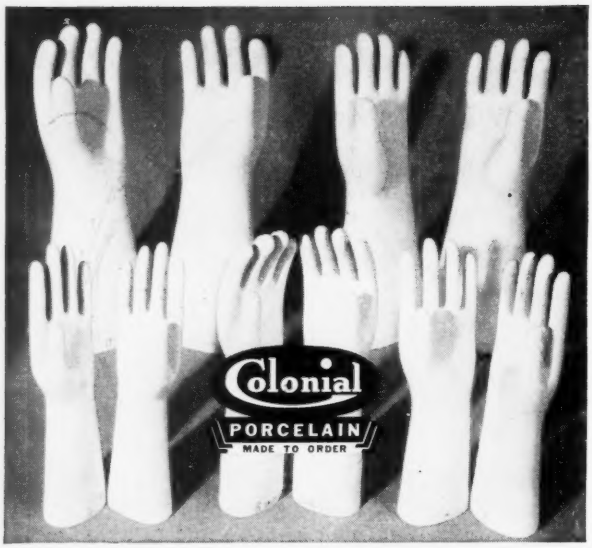

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points out. The particles of zinc oxide (as well as the particles of zinc salts produced by the action of oxides on the peptizers T. B.—Tudas, thiuram—or G.S.—Altax) apparently serve as intermolecular links and reinforce chain to chain cohesion by secondary valences or Van de Waals forces. These linkages by particles of oxide would evidently reinforce interchain friction forces; they would also increase the resistance to tearing and decrease the flow and thermoplasticity phenomena, but without reducing them to negligible values. These linkages by oxide particles, though more numerous are yet less powerful than the purely chemical linkages created by the sulfur bridges between chains of natural rubber, or of butadiene-type rubbers, or those created by oxygen atoms between neoprene chains, for instance.

Hence thiorubber vulcanization in its present form could very well be designated "pseudo-vulcanization," a conception justified by the imperfect transformation of the plastic to the elastic state and by the relatively modest properties of thiorubber vulcanizates observed. More detailed analysis will probably also make it possible to understand that in some cases the transformation is not irreversible and thereby to explain the reversion of certain vulcanizates.

In conclusion the author states that other tests have also been begun which aim at distinguishing commercial products and at putting in their proper light factors of manufacture. He points out that while X-rays constitute an eminently suitable means for this kind of research, they do not reveal all that it might be desired to know about the system being studied —for instance, they give no information on the average molecular weight or the amorphous phase. For fullest satisfaction, therefore, the method discussed should be used in conjunction with chemical, physical and physico-chemical methods, and, above all, with practical studies made in the factory or the control laboratory.

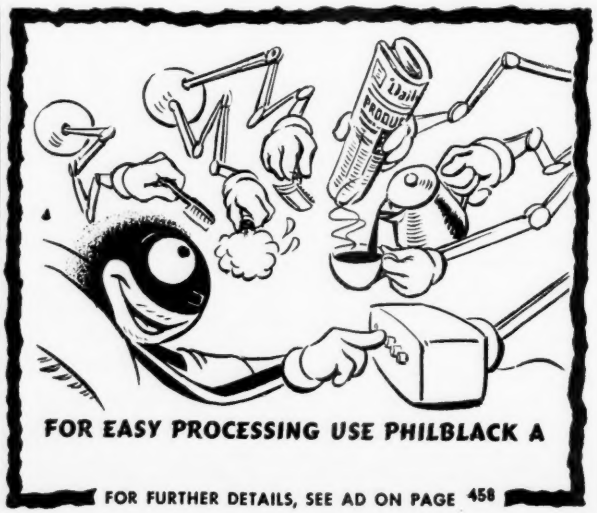
The thiorubbers used in the above experiments were for the most part of French manufacture, especially Thiogomme "S."

Exhibits at First Postwar Auto Show

The thirty-third *Salon de l'Automobile* (Automobile Show), the first to be held since 1938, was one of the outstanding events in Paris, when from October 3 to 13 models of the latest French cars were viewed with the hope that before long they would become generally available. As usual, a number of rubber manufacturers exhibited their wares, with makers of tires predominating.

Michelin featured its Métallic heavy-duty tire in the carcass of which fine steel wires replace the usual cotton cords. Among the advantages claimed for steel over cotton in this application are the superior resistance to high temperature, the possibility its use offers for reducing the thickness of the carcass, whereby less heat is generated, and greatly increased mileage. From the standpoint of French economics, equally important advantages are that cotton, which must be imported, can be replaced by home-produced steel, and that the use of the latter permits a reduction of 30 to 40% in the amount of still precious rubber required per tire.

Television, phosphorescent cycle tires, and tennis balls drew



FOR FURTHER DETAILS, SEE AD ON PAGE 458

attention at the stand of French Dunlop. Here were shown tires for all purposes—automobiles, cycles and motorcycles, farm appliances, and airplanes. All Dunlop inner tubes are now made of natural rubber, and the proportion of natural rubber in tire carcasses has been increased. Various accessories for automobiles and cycles were also on display here.

The French branch of the Goodrich company, formerly known as Société Colombes-Goodrich, but recently restyled Kléber-Colombes, displayed, in addition to tires made of natural rubber and GR-S, and rayon instead of cotton, heavy-duty tires and inner tubes, both made of all natural rubber. There were also to be seen V-belts, hose and other rubber parts for automobiles, as well as "Sol" tires for use on the farm and made of a special compound said to be highly resistant to the action of the rays of the sun.

Other firms represented at the show included the tire manufacturers Bergougnan, Société Englebert, and Société Anonyme Wolber; Establissements Paulstra, which demonstrated the uses of rubber bonded to metal; Société Auto Cable, which showed insulated wires and cables and a variety of mechanical goods; the tire retreaders, Tyresoles; and various manufactures of vulcanizing apparatus.

CZECHOSLOVAKIA

By a trade agreement between Czechoslovakia and Holland, valid for one year from October, 1946, Holland is to supply various manufactured products and raw materials including rubber and tin in exchange for timber, paper, machinery, textiles, chemical products, etc.

The rubber industry in Czechoslovakia seems to be recovering comparatively rapidly in spite of various shortages which hamper export business. A press report indicates that the country was able to export rubber goods in July, 1946, with a value of about $650,000.

Czechoslovakia also seems to have made much headway in the production of synthetic plastic goods, and samples shown at the Prague Trade Fair held last year aroused much interest among numerous foreign countries, and Austria and Switzerland, in particular, offered large orders.

GREAT BRITAIN

Thomas De La Rue & Co. is negotiating for the formation of a new company, National Plastics, Ltd., which is to acquire and merge the undertakings of De La Rue Plastics, Ltd., and Molded Products, Ltd. The firm of Thomas De La Rue & Co. will have a substantial interest in the new concern. The chairman and managing director of the parent organization, B. C. Westall, will also be chairman of the new enterprise; deputy chairman will be W. J. Merifield, chairman of Molded Products; while H. W. F. Ireland, managing director of the same firm, together with H. P. Bridge, managing director of De La Rue Plastics, are to be joint managing directors of the new company.

British Celanese, Ltd., is to take over a 214-acre site at Wrexham on long-term lease for extending the manufacture of plastics and textiles. It is intended to build new factories in addition to using the existing buildings, and eventually about 5,000 workers may be employed. To begin with, however, production will be on a limited scale requiring about 300 workers.

British Insulated Callender's Cables, Ltd., is buying a 23-acre site on the Kirby trading estate of the Liverpool corporation, where a new factory, to cost £600,000, is to be built to expand the manufacture of electric cables and other electrical equipment.

The success which the exposition of its goods in Birmingham met last June, encouraged Rubber Bonders, Ltd., to stage a similar exhibition in Manchester from December 16-20, 1946.

Dunlop Rubber Co. (Scotland), Ltd., has been formed with a capital of £50,000 in £1 shares to manufacture and deal in rubber, gutta percha, balata, etc.

G. Wilson, export manager of India Tire & Rubber Co., Ltd., is visiting South Africa and countries in the Near East in connection with plans for expansion of overseas markets.

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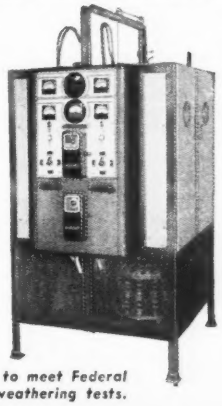

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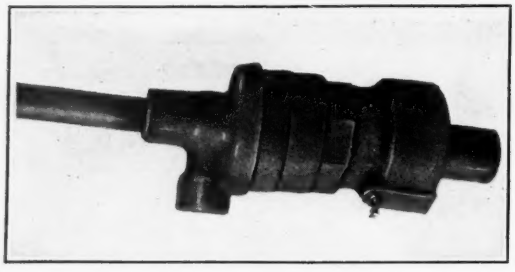

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SPAIN

Plastics manufacture appears to be expanding in Spain. Recently a new firm, Resins Artificiales Viladecans S.A., was authorized by the Spanish Ministry of Industry and Commerce to build a factory for the manufacture of transparent methacrylate plastics.

At the same time the Ministry received a request from Productos Intermedios S.L.E., San Celoni, to be permitted to increase the capacity of its phthalic anhydride plant by 150 tons annually.

HOLLAND

According to an official announcement of the Netherlands Government, an ordinance of September 10, 1946, imposes to a charge of 1½% of the invoice value on all raw materials used in the manufacture of rubber goods and of 0.75% on finished goods consisting mainly of rubber. Raw materials are understood to include rubber, gutta percha, ebonite, synthetic rubber-like substances, hard or in liquid form, unvulcanizable rubber-like materials, and waste rubber.

The Fall Fair, which took place in Utrecht in mid-September, saw the record number of 1,977 participants, compared with 1,629 at the preceding Spring Fair and 1,200 at the last industrial fair before the war. The Netherlands was represented by roughly two-thirds of the total number of exhibits; then came Great Britain with 204, and the United States with 140. The American firms represented included American Cyanamid & Chemical Corp., Goodyear Tire & Rubber Co., and United States Rubber Export Co., Ltd.

The date for the next Utrecht Spring Fair has not yet been fixed.

NORWAY

The Norwegian Industrial Research Society, a war-born organization, has been studying various projects with the aim of expanding Norway's industries. Largely as a result of spade work by this organization, Norway is about to embark on the manufacture of plastics. A company has already been formed, known as Norsk Kunstharpikser A/S (Norwegian Synthetic Resins, Inc.), which is now negotiating for building sites and hopes to be able to begin production in the latter part of this year.

SWEDEN

Imports into Sweden in the first nine months of 1946 included 8,206,917 kilograms of rubber, as compared with 2,525,045 kilograms in the corresponding period of the preceding year; also 24,827 kilograms of rubber heels and soles in the 1946 period (none in the 1945 period); 634,808 kilograms of belting, against 14,179 kilograms; 2,488 kilograms of rubber parts for bicycles; 2,933,390 kilograms of rubber parts, including tires, for automobiles and motorcycles, against 75,414 kilograms; 283,687 kilograms of other rubber goods including surgical articles, against 43,172 kilograms; 231,392 kilograms of elastic bands, against 27,649 kilograms; and 19,023 kilograms rubber footwear against 191 kilograms.

While imports showed the substantial increases that were to be expected, exports dropped, in some cases, quite sharply. Exports of sheets, packing, and rods of rubber were 43,664 kilograms, in the nine-month period of 1946, against 59,910 kilograms in 1945; rubber parts for automobiles, including tires, 4,371 kilograms, against 4,834 kilograms; rubber footwear, 2,178 kilograms, against 4,598 kilograms; and rubber-soled footwear, 1,545 kilograms, against 34,454 kilograms.

FAR EAST

INDIA

Laminated Plastics

Because of the absence of a flourishing chemical industry, the field of synthetic resins had hardly been touched in India so that during the war India had to make use of natural resins in the production of laminated plastics to replace metals, then in short supply, for various articles. Shellac proved the most useful of the natural resins for the purpose, and a wide variety of laminated products, containers, and drawn and laminated moldings was made.

In an article on the subject in the *Chemical Age* of London, and reproduced in the London *Rubber Age*,[1] Chandra Kant gives details of manufacturing processes and applications of these laminates.

The earliest investigations in making shellac fabric laminates were started in 1926 in the University Chemical Laboratories, Lahore, India, but it was not until 1940, when the Board of Scientific and Industrial Research was organized, that the matter was seriously taken up, after which time progress was rapid.

Aqueous alkaline dispersions and solutions of shellac in easily available solvents, as methylated spirit, together with hardening agents, were successfully employed for impregnating jute cloth, cotton cloth, paper, etc., for the production of laminated sheets and boards, used extensively in the manufacture of such widely different articles as material for the construction of partitions, electrical accessories, and switchboards, piston ring jigs, tea chests, etc.

Jute fabric-shellac laminates, known as "Jutlac," were used for tea chests, grease drums, and other articles and were also used by the British and American Military and Air Force Services.

Laminate boards having remarkable shock-resistant properties besides low water absorption were produced with the aid of an alcoholic solution of resin made by modification of shellac with urea or melamine.

For making plastic fuel containers holding up to four gallons, laminates of fabric impregnated with solutions of shellac in alcohol or ammonia proved useful. For jettison tanks required by the United States Air Forces, dispersions of shellac in water, or molten lac with extenders or wetting agents were preferred. The difficulty of procuring heavy hydraulic presses and mold equipment led to the development of simple manufacturing processes adapted to cottage industry procedure. In one method of making four-gallon gasoline containers, a well-plasticized resin solution of dewaxed shellac and depolymerized shellac with urea as hardening agent was spread on the fabric with a paint brush. Layers of the treated fabric, cut to size, were pressed together by hand with formers of wood or hot iron to build the body and separate end pieces; and the whole was then assembled and next joined together by means of resin cement.

Another inexpensive method was what may be termed "on-the-spot" impregnation of single-ply canvas envelopes of jettison tanks. These envelopes were brought to the front and spread out in the field. Then a composition, in powder form, of shellac, casein, portland cement, borax, sodium carbonate and urea, was dispersed in water and introduced into the canvas tanks which were then blown up by means of ordinary tire inflaters to an air pressure of two p.s.i.; then the tank, under pressure, was rolled about to permit the resin solution to spread and seep through the pores of the canvas impregnating it. The solution that oozed out was spread over the outside of the containers and allowed to dry, forming an impervious film in a few hours. By this process jettison tanks were produced holding up to 70 gallons, which were useful enough for their purpose, since they were used only once.

Other investigations on the manufacture of containers from laminates led to the development of a technique for producing both simple and intricate shapes by a method permitting laminates to be drawn and molded in a single operation. It is expected that it will be possible to use the process in the manufacture of luxury goods, electrical equipment, and above all for automobile body panels.

[1] Nov., 1946, p. 266.

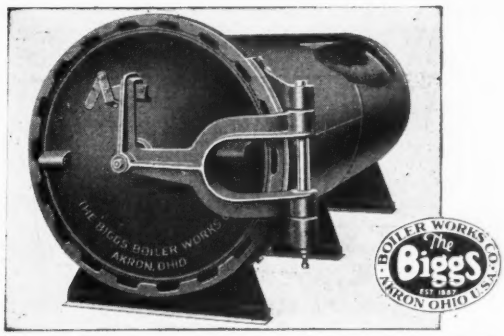

Fig. 17. Welded steam-jacketed, staybolt-less, horizontal vulcanizer with quick-opening door. All sizes; various working pressures. Low maintenance.

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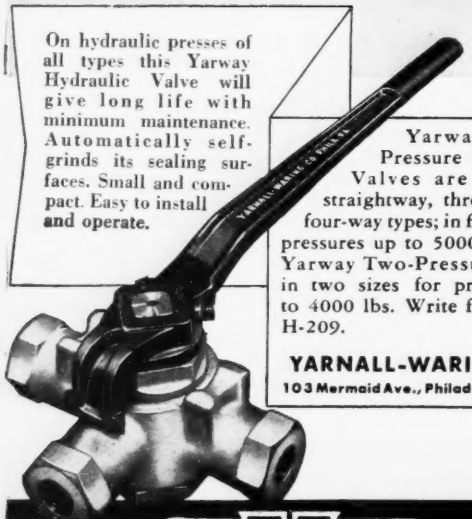

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Editor's Book Table

BOOK REVIEWS

"Emulsion Technology. Theoretical and Applied. Including the Symposium of Technical Aspects of Emulsions." Second Edition. Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. Cloth, 8½ by 5½ inches, 368 pages Index. Price $6.50.

This volume, as with the original edition, contains the contributions of 20 European colloid scientists and consists, with some revisions and additions, of the papers presented at the second symposium on emulsions sponsored by the British Section of the International Society of Leather Trades Chemists. These sections are essentially unchanged from the first edition, but the new book also contains a comprehensive section on the theory of emulsions and emulsifying agents by G. M. Sutheim, an American specialist. Included in this section is an up-to-date list of emulsifying agents classified in the following groups; anion-active, cation-active, non-ionic, and miscellaneous. It lists in addition to the commercial and/or chemical name, the chemical composition, the type of emulsion it helps to produce, physical properties, suggested uses, and manufacturers of the emulsifying agents.

The initial chapters deal with the mechanics and fundamental principles of emulsification. Following are sections dealing with the use of emulsions in medicine, agriculture, and industry. Chapters on the design of emulsifying machinery, industrial formulations, and emulsion properties are also included, besides a chapter on emulsions in the patent literature containing some 244 references. Concluding the volume is the new chapter on theory of emulsions and the list of emulsifying agents. Each chapter contains many literature references.

"The History and Romance of Elastic Webbing." Clifford A. Richmond. Easthampton News Co., Easthampton, Mass. Cloth, 6 by 9¼ inches, 218 pages. Price, $1.50.

As stated in the book, this history of the elastic webbing industry is presented as a labor of love by the author, who is chairman of the board of United Elastic Corp. The brief index lists 37 chapters or divisions, broken down either by geographical sections, by companies, or by men. This index, however, shows only a small part of the wealth of material included in the volume. A comprehensive index of companies and men covered in the book would be of value.

The record begins with Luther Clark in 1838, reviews the work of Goodyear, the earliest weaving of elastic web, and goes into the ramifications of the multitude of businesses involving elastic webbing from 1838 to the present day, including the activities of the rubber thread companies. The book is filled with names, companies, places, and an occasional anecdote, and is characterized by its overall impression of completeness and authoritativeness.

"Soap in Industry." Georgia Leffingwell and Milton Lesser. Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. Cloth, 8¾ by 5½ inches, 210 pages. Price, $4.

As stated in the introduction, this book is intended to be an indicative rather than an exhaustive survey of the industrial uses of soluble soaps (potash and soda soaps as contrasted with the heavy metal soaps), with particular emphasis on the growing place of these soap uses in our industry.

Each chapter is devoted to a particular industry and discusses the use of soaps in that industry. Formulations and results obtained are given together with comprehensive literature references. Industries thus discussed include animal husbandry, building and construction, cosmetics, dentistry, inks and ink making, insecticides, leather, lubricants, milk production, mining and ore treating, oil production, paints, paper and packaging, plastics, metal, glass and wood polishes and cleaners, restaurant sanitation, road building and maintenance, rubber production, textiles, dyeing and printing textiles, wool production.

The chapter on rubber production gives brief discussions of the use of soap in emulsion polymerization of synthetic rubbers, preparation of reclaimed rubber dispersions, emulsification of latex compounding ingredients, stabilization of emulsions, mold lubricants and dusting agents, stabilization of foam sponge rubber, preparation of rubber adhesives, and as an ingredient in latex purification. The chapter on plastics similarly covers the use of soaps in emulsion polymerization of resins, and the many types of resin emulsions.

NEW PUBLICATIONS

Publications of B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 13, O. **"Vultrol."** Service Bulletin 46,RC1, February 15, 1946. 18 pages. Formulations, test results, and diagrams are given to show the effectiveness of Vultrol as an anti-scorch material, especially in GR-S stocks accelerated with combinations of MBT and DPG, and as a processing aid for scorched or bin cured GR-S stocks. **"Vultrol in Processing Hycar OR-15."** Service Bulletin 46-RC2, April 15, 1946. 4 pages. This bulletin gives laboratory test data showing the effectiveness of Vultrol in retarding scorch of a typical Hycar OR-15 stock without loss in quality at optimum cure, and in increasing the plasticity of the batch. **"Activated Good-Rite Erie in GR-S Tire Compounds."** Service Bulletin 46-RC3, May 1, 1946. 5 pages. The effect of Good-Rite Erie in a typical GR-S tire stock, when activated by various thiuram accelerators, is shown by means of test data on varying formulations and curing cycles. The material is shown to give high-quality tread stocks with low heat build-up and freedom from scorch. **"Geon 500 Series Polyblends."** Service Bulletin 46-H1, November 10, 1946. 3 pages. The Geon 500 Series, colloidal blends of polyvinyl resins and nitrile rubber polymers, are described herein. Physical properties and typical formulations are given, together with information on fabrication, compounding ingredients, and curing methods. **"Glossary of Technical Words, Terms and Phrases Used in the Plastics and Rubber Industries."** 12 pages. This handy glossary contains some 98 definitions of value to the plastics material manufacturer, fabricator and designer. It provides a ready reference for terminology of words and materials associated with plastics and nitrile rubbers.

"Foreign Commerce and Navigation of the United States for the Calendar Year 1943." Bureau of the Census, United States Department of Commerce, Washington, D. C. Volume I, 1046 pages; Volume I Supplement, 363 pages; Volume II, 452 pages. For sale by the Superintendent of Documents, Washington, D. C. Publication of the 1943 annual report of foreign commerce of the U. S. was delayed by war restrictions. As in preceding reports, statistics are given for imports, exports, and export transports according to article, country, and customs district. Figures are included for scrap rubber, synthetic rubber, rubber and rubber substitutes, cements, compounding ingredients, and products.

"Phillips Soltrols." Bulletin No. 150. Phillips Petroleum Co., Bartlesville, Okla. 4 pages. Inspection data on the company's series of Soltrols, low-odor naphthas of narrow boiling range and high paraffinic content, appear together with brief, general descriptions of their uses in insecticides, odorless paints, dry cleaners, solvents, and chemical intermediates.

Bulletins of Rohm & Haas Co., Washington Square, Philaphia, Pa. **"Thermal Properties of Plexiglas."** 7 pages. "Alinment Chart for Calculating Heat Transfer from Air to Air through Plexiglas Panels." 4 pages. The information contained in these bulletins offers the engineer and designer a quick and accurate method of determining heat losses through Plexiglas, the thickness of material necessary to effect a desired insulation, and other vital technical data relating to thermal properties. Data and diagrams are given on Plexiglas's coefficient of thermal expansion, specific heat, coefficient of thermal conductivity, and an alinment chart for determining heat transfer from air to air through Plexiglas panels.

"Five Years of Synthetic Rubber." United States Rubber Co., Rockefeller Center, New York 20, N. Y. 50 pages. Intended for students, educators, and interested members of the public, this booklet in simple language shows the growth of the synthetic rubber industry and gives an appraisal of its present-day importance in the manufacture of rubber products. Section headings cover synthetic rubber before the war; the types of synthetic rubber; the discovery of synthetic rubber; the government rubber program; present status of the synthetic rubbers; the manufacture of GR-S; uses of natural and synthetic rubber in tires; reconversion to natural rubber; and what materials are polymers. There are also three technical appendices covering comparative properties of natural and synthetic rubber, chemical structure of rubber, and chemical resistance of synthetic rubber, and a glossary of technical terms.

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"Sun 'Job-Proved' Products for Industry." Sun Oil Co., Philadelphia 3, Pa. 4 pages. This bulletin is a guide to some of the company's more widely used products. Product names and brief notes on special properties for specific applications are listed under various classifications, including processing oils, industrial oils, industrial greases, metal working oils, motor products, and miscellaneous industrial products.

"Hercules Products for Protective Coatings." Hercules Powder Co., Wilmington, Del. 4 pages. This folder presents a convenient listing of the company's products according to the various types of protective coatings in which they are used. Brief descriptive notes are also included to explain why the product is used for the indicated purpose. Coatings listed cover various types of paints, varnishes, driers, thinners, and paint removers.

"Wilmac D-X as a Substitute for Stearic Acid in a Natural Rubber Tread Stock." Wilmington Chemical Corp., New York, N. Y. November 20, 1946. 3 pages. Formulations for five stocks and physical properties obtained with the vulcanizates under various curing and aging cycles are listed to show that Wilmac D-X can be used as a replacement for stearic acid in natural rubber tread stocks.

"Predicting Volume Increase of Perbunan Compounds in Petroleum Products." Tentative Supplement No. VIII; Section No. VI. Enjay Co., 26 Broadway, New York, N. Y. 4 pages. This bulletin describes the Howlett method for quantitative prediction of the volume increase of a Perbunan compound intended for contact with petroleum products. The volume increase data obtained for a given compound can be used to formulate a new recipe intended to resist a particular fluid. A table is included of volume increase and extract coefficient values of Perbunan compounds after immersion in various petroleum products.

"Progress Report on Synthetic Rubber Insulation." E. W. Davis. Simplex Wire & Cable Co., Cambridge, Mass. 4 pages. This paper gives a summary of factory and laboratory test made on performance grade and heat-resistant grade GR-S insulation. Illustrative charts compare these grades with natural rubber insulation as regards tensile strength, elongation, time to crack, and mechanical water absorption both before and after various aging cycles.

"Positex." Positex Pamphlet No. I. C. M. Blow. The British Rubber Development Board, 19 Fenchurch St., London E.C. 3, England. 8 pages. This publication describes the properties and applications of Positex, a new form of natural rubber latex with reversed charge and available in cured and uncured grades. This reversal of charge increases affinity toward textiles and allows deposition of latex on fabric in discrete particles, rather than in a continuous film.

"The Neoprene Notebook." No. 27, October, 1946. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. 8 pages. This issue contains sections on the creep of neoprene in shear, as evaluated by laboratory tests; neoprene patches for steel mill rolls; use of neoprene in resilient seals and grommets; neoprene-jacketed trailing cables to meet new flame resistance requirements; neoprene hydraulic hose; and a new marine valve using a neoprene coated ball to replace flappers.

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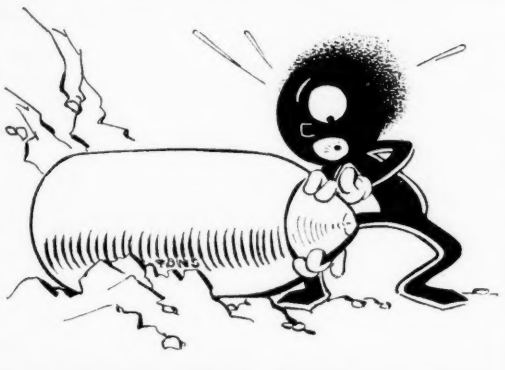
New Pressure Gage

(*Continued from page* 574)

are furnished with a strong wooden carrying case. Listed models are stated to be available for delivery in 30 days or less.

The new gage works in vises, between all types of clamps, and can even be converted into a miniature testing machine. The manufacturer, W. C. Dillon & Co., Inc., states that the device is almost entirely unaffected even by extreme temperature changes and can be used indoors or outdoors. In cases where the operator cannot get close enough to read the dial, remote repeater stations that work up to 500 feet and more can be supplied.



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Market Reviews

COTTON & FABRICS

NEW YORK COTTON EXCHANGE
WEEK-END CLOSING PRICES

Futures	Oct. 26	Nov. 30	Dec. 7	Dec. 14	Dec. 21	Dec. 28
Mar.	32.90	30.70	30.75	32.45	32.60	32.82
June	31.88	29.23	29.35	31.43	31.45	31.48
Aug.	30.28	27.54	27.67	29.86	29.67	29.69
Oct.	28.05	25.72	25.80	27.78	27.37	27.54
Dec.	27.70	25.13	25.28	27.35	26.95	27.23

THE basic undertones of the cotton market were optimistic during December as prices moved irregularly upward. The 1⅛-inch middling spot price rose from 31.08c on December 1 to the monthly peak of 34.45c on December 26, and closed at 33.39c on December 31. The March 1947 futures market followed the same pattern as the spot market. Starting at 30.03c on December 1, it rose irregularly to a peak of 33.34c on December 26, and closed at 32.25c on December 31.

The major factors influencing trading were: (1) the belief that mill demand would drop after the holidays, based on widespread predictions of an imminent mild recession; and (2) the known favorable supply situation, it being pointed out that current production was almost 2,000,000 bales below domestic consumption at current rates. Other optimistic factors were expectations of tax reductions by the new Congress and the prospects that revised labor laws would eliminate many of the bottlenecks caused by recurrent strikes. The increase in volume of sales in the spot market gave evidence that farmers were finally releasing part of current production into the market.

Sharp differences of opinion were expressed by Commodity Exchange Authority officials and representatives of the New York Cotton Exchange at a CEA hearing on December 10. The hearing was held to consider the Secretary of Agriculture's proposal that cotton futures trading be held to 30,000 bales a day in all futures combined. CEA officials expressed the belief that the October break in cotton prices was occasioned by large speculative accounts being held at that time and urged the adoption of the trading curb to prevent future breaks. Frank Knell, president of the New York Exchange, disagreed with these views and expressed the opinion that the break was due to the liquidation of several large holdings, the unsettled world cotton market conditions, and government price ceilings. He termed the suggested limit an unreasonable restriction. Darwin Fenner, president of the New Orleans Cotton Exchange, also expressed opposition to the suggested limit and urged adoption of his exchange's plan for increased margin on cotton trading. At the conclusion of the hearing it was announced that CEA would study the evidence presented and might issue a tentative order on the proposal pending a final decision.

The Department of Agriculture estimated domestic production at 8,482,000 bales, as of December 1; while domestic consumption, as estimated by the National Cotton Council, was forecast at 10,000,000 bales. Foreign demand of about 3,000,000 bales, in addition to the excess domestic demand, will cut sharply into the 7,522,000 bales carried over from last season. The tight supply situation was foreseen as continuing through the 1947-48 season.

The grade and staple length of cotton ginned in the United States through November 30 is higher than for either of the past two seasons, according to the Department of Agriculture. The grade index of this year's crop is expected to average about 95.5, using middling white as the index for 100, as compared with 91.8 last year and 93.4 two years ago. The average staple length this year will be about 32.5/32-inch, as compared with 32.2 in 1945 and 31.9 in 1944.

Fabrics

Demand for all types of cotton cloth continued high during the month. Practically all price changes recorded showed an upward trend, but a large proportion of the gray cloth market is sold fairly well ahead at old ceiling prices. While some houses held to old ceilings even for quick deliveries, an average of between 15 and 20% over former maximum prices was fairly consistently obtained for immediate release, and most mills were sold up tight until the end of March and partially through the second quarter. Activities for immediate delivery centered in the second-hand cloth market. It was reported that prices as much as 30% above old ceilings were being snapped up for deliveries as far forward as May.

Many converters have already begun incorporating new protective clauses in contracts currently being negotiated. One clause covers increased finishing costs; most finishing plants have already increased their rates, and there are indications that a further increase may be forthcoming. The second clause covers increased gray goods costs, in view of new wage contracts negotiated by some mills.

Reports are that prices of rubber hollands and of hose and belting remained unchanged during December. Present indications are that supplies of hose and belting will be inadequate to meet demand for at least the first half of 1947. The raincoat industry is experiencing the customary seasonal slow-down, but expects a fairly good spring business, starting around February 15.

RAYON

OF SPECIAL interest to the tire industry was the announcement that tire-type high-tenacity rayon cord, fabric, or yarn, heretofore limited to certain specified uses, may now be used by the rubber manufacturers for any purpose they desire. This action, taken on December 17 by the Rubber Division of the Office of Temporary Controls, consisted of deleting List 15 to Appendix II to R-1 and follows removal of all other controls affecting rayon cord, fabric, and yarn. This relaxation of controls will permit manufacturers to offer a passenger tire of 6.00 size and smaller with rayon cords.

On the other side of the picture was the effect of the tightening supply of caustic soda, particularly during the first part of December, in drastically reducing production of rayon tire yarns and staple fiber. Several rayon plants were shut down, and others operated at only 50% of capacity during the latter part of November and the early part of December. With the settling of the coal strike some improvement in supplies of caustic soda became apparent, with consequent increase in rayon production.

A higher tariff on rayon staple to protect domestic cotton and rayon industries was urged by rayon yarn producers in a brief submitted December 18 to the Committee on Reciprocal Trade Agreements of the Federal Tariff Commission. Cotton and rayon can coexist in domestic markets only if a higher duty on rayon is imposed and rayon production increases in comparison with rising costs. Pulling down tariff barriers, it was aruged, would result in a flood of rayon staple from foreign producers and tremendously aggravate the domestic cotton problem.

A new development in the use of rayon which began affecting market calls was its application in plastic laminating, replacing cotton and glass fabrics in many instances as the laminant.

Rayon shipments during November totaled 70,500,000 pounds ,or 6% below the October figure of 75,100,000. November rayon filament yarn shipments amounted to 57,500,000 pounds (41,200,000 pounds of viscose plus cupra, and 16,300,000 pounds of acetate); while staple deliveries aggregated 13,000,000 pounds (9,400,000 pounds of viscose, and 3,600,000 pounds of acetate). End-of-month rayon stocks held by producers on November 30, 1946, totaled 8,200,000 pounds of viscose plus cupra yarn, 1,800,000 pounds of acetate yarn, and also 2,600,000 pounds of staple.

Fixed Government Prices*

	Price per Pound	
	Civilian Use	Other Than Civilian Use
Guayule		
Guayule (*carload lots*)	$0.17½	$0.31
Latex		
Normal (*tank car lots*)	.26	.43½
Creamed (*tank car lots*)	.26¾	.44¼
Centrifuged (*tank car lots*)	.27¾	.45¼
Heat-Concentrated (*carload drums*)	.29½	.47
Plantation Grades		
No. 1X Ribbed Smoked Sheets	.22½	.40
1X Thin Pale Latex Crepe	.22½	.40
2 Thick Pale Latex Crepe	.22	.39½
1X Brown Crepe	.21⅜	.38¾
2X Brown Crepe	.21⅛	.38½
2 Remilled Blankets (Amber)	.21¼	.38¾
3 Remilled Blankets (Amber)	.21⅛	.38½
Rolled Brown	.18	.35½
Synthetic Rubber		
GR-M (Neoprene GN)	.27½	.45
GR-S (Buna S)	.18½	.36
GR-I (Butyl)	.18½	.33
Wild Rubber		
Upriver Coarse (crude)	.12⅝	.26¼
(washed and dried)	.20¼	.37¼
Islands Fine (crude)	.14⅝	.28¼
(washed and dried)	.22½	.40
Caucho Ball (crude)	.11⅝	.24¾
(washed and dried)	.19½	.37
Mangabiera (crude)	.08½	.19¾
(washed and dried)	.18	.35½

* For a complete list of all grades of all rubbers see Rubber Reserve Co. Circular 17, p. 169, May, 1943, issue.

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RECLAIMED RUBBER

THE favorable position of the reclaim market remained unchanged during December. Production remained at top levels, with a continuing excess demand, although price levels were still at former ceilings. Reclaimers also continued to enjoy a buyers market for scrap rubber because of good stocks on hand that enable them to refuse the higher asking prices for scrap.

Final September and preliminary October figures on reclaim are now available. Production of reclaim in September was 23,956 long tons; consumption, 23,715 long tons; exports, 579 long tons; and end-of-month stocks, 35,404 long tons. Preliminary figures for October show a production of 26,575 long tons; consumption, 26,162 long tons; exports, 759 long tons; and end of month stocks, 35,058 long tons. It should be noted that October consumption of reclaim was the first month since March, 1944, to total more than 25,000 long tons.

Reclaimed Rubber Prices

	Sp. Grav.	¢ per Lb.
Auto Tire		
Black Select	1.16-1.18	7½ / 7¾
Acid	1.18-1.22	8½ / 8¾
Shoe		
Standard	1.56-1.60	8 / 8¼
Tubes		
Black	1.19-1.28	12¼/12½
Gray	1.15-1.26	13 /14
Red	1.15-1.32	13 /13½
Miscellaneous		
Mechanical blends	1.25-1.50	5½ / 6½

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

TRADING in scrap rubber continued at a low point during December. With reclaimers not inclined to pay higher prices, scrap dealers are facing the prospect of continued apathy from consumers of scrap tires, tubes, and tire parts. The situation in scrap rubber has been aggravated by the fact that crude rubber has been coming in greater abundance and that scrap rubber has to compete with synthetic and plastics. The prospect of higher freight rates in January is also seen as a deterrent to movement of scrap rubber. Dealers are therefore still looking to export business as a means of disposing of scrap tires, and it is reported that the scrap market in the Far East and in South America is still good.

Dealers reported that prices were being maintained at published levels, but that it was impossible to work at a profit margin under these prices. Smaller operators were switching to other scrap and waste materials with higher profit margins, and the volume of scrap rubber was being definitely reduced.

Following are dealers' buying prices for scrap rubber, in carload lots, delivered points indicated:

	Eastern Points	Akron, O.
	(Net Tons)	
Mixed auto tires	$17.50	$19.50
Truck and bus tires	17.50	19.50
Beadless tires	23.00	24.50
S.A.G. passenger (natural)	17.50	18.00
S.A.G. passenger (synthetic)	nom.	nom.
S.A.G. truck (natural)	15.50	16.00
S.A.G. truck (synthetic)	nom.	nom.
No. 1 peelings (natural)	45.00	46.00
No. 1 peelings (synthetic)	nom.	nom.
No. 1 peelings (recap.)	nom.	nom.
No. 2 peelings (natural)	31.00	31.50
No. 2 peelings (synthetic)	nom.	nom.
No. 2 peelings (recap.)	nom.	nom.
No. 3 peelings (natural)	28.00	29.00
No. 3 peelings (synthetic)	nom.	nom.
	(¢ per Lb.)	
Mixed auto tubes	6.0	5.5
Red passenger tubes	7.25	7.25
Black passenger tubes	6.25	6.25
Black truck tubes	6.0	6.0
Mixed puncturepoof tubes	2.0	2.0
Aid brake hose	nom.	nom.
Rubber boots and shoes	nom.	nom.

Compounding Ingredients Price Changes and Additions

Accelerators, Inorganic

Lime,hydrated	ton	$8.00 /$11.65
Litharge, commercial	lb.	.1375/ .1575
Eagle, Sublimed	lb.	.15 / .155
National	lb.	.15 / .155
Red lead, commercial	lb.	.15 / .1675
Eagle	lb.	.16 / .165
National	lb.	.16 / .165
White lead, basic	lb.	.1425/ .145
Eagle	lb.	.1425/ .145
National	lb.	.1425/ .145
Silicate	lb.	.15 / .155
Eagle	lb.	.15 / .155

Accelerators, Organic

A-10	lb.	.40 / .47
Butyl Eight	lb.	1.00 / 1.05
DPG (diphenylguanidine)	lb.	.39 / .45
El-Sixty	lb.	.39 / .46
Hepteen	lb.	.42 / .48
Base	lb.	1.80 / 1.90
Safex	lb.	1.15
Thiocarbanilide	lb.	.34 / .39
Ureka	lb.	.55 / .62
Blend B	lb.	.55 / .62
C	lb.	.52 / .59

Activators

Stearic acid, single pressed	lb.	.32 / .34
Double pressed	lb.	.335 / .345
Triple pressed	lb.	.3625/ .3725

Antioxidants

Age-Rite Alba	lb.	2.15 / 2.25
Gel	lb.	.55 / .57
H.P.	lb.	.58 / .60
Hipar	lb.	.70 / .72
Powder	lb.	.43 / .45
Resin	lb.	.52 / .54
D	lb.	.43 / .45
Stalite	lb.	.43 / .45
White	lb.	1.30 / 1.40
Aminox	lb.	.43 / .52
Aranox	lb.	2.15
Betanox Special	lb.	.61 / .70
B-L-E	lb.	.43 / .52
Flexamine	lb.	.58 / .67
Oxynone	lb.	1.15 / 1.22
Perflectol	lb.	.58 / .65
Rio Resin	lb.	.43 / .45
Santovar-A	lb.	1.30 / 1.37
Santowhite	lb.	1.40 / 1.52
Sunproof	lb.	.23 / .28
Jr.	lb.	.17 / .22
Tysonite	lb.	.215 / .2225

Brake Lining Saturants

Resinex L-5	lb.	.0175/ .025

Colors

Blue

Stan-Tone	lb.	1.40 / 4.40

Green

Stan-Tone	lb.	1.60 / 3.60

Orange

Stan-Tone	lb.	2.20

Red

Stan-Tone	lb.	1.10 / 2.20

White

Zinc oxide, Azo 35% leaded	lb.	$0.105¢/$0.107⅛
Eagle, 35% leaded	lb.	.10⅝/ .11
50% leaded	lb.	.11⅛/ .115
Florence Green Seal-8	lb.	.1075/ .11

Yellow

Chrome	lb.	.24 / .26
Stan-Tone	lb.	1.20 / 1.75

Extenders

Extender 600	lb.	.208

Fillers, Inert

Clay, Champion	ton	13.00
Stellar-R.	ton	50.00
Lead sulfate, basic	lb.	1325/ .135

Finishes

Wax, Bees	lb.	.56 / .70
Carnauba	lb.	1.55 / 1.92
Montan	lb.	.56 / .58

Mold Lubricants

Montan Wax	lb.	.54 / .55

Plasticizers and Softeners

Barium stearate	lb.	.50 / .51
Bunarex resins	lb.	.055 / .065
Calcium stearate	lb.	.47 / .48
Dibutyl sebacate	lb.	.557 / .562
Picco 75	lb.	.105
Piccolyte resins	lb.	.19 / .225
Piccoumaron resins	lb.	.0625/ .11
Piccovars	lb.	.11 / .115
Plasticizer SC	lb.	.75
Resinex	lb.	.0275/ .0325
L-4	lb.	.0175/ .025
Stearic acid, single pressed	lb.	.32 / .34
double pressed	lb.	.335 / .345
triple pressed	lb.	.3625/ .3725

Reclaiming Oils

Picco C-32	gal.	.33 / .38

Reinforcers, Other Than Carbon Black

Bunarex 50, 75, 100, 115	lb.	.055 / .065
Clay, China	ton	9.00 /15.50
Naftex EPC-80	lb.	.0825/ .1125
HMF-67	lb.	.06⅝/ .08⅜
—75	lb.	.07 / .09
MPC-80	lb.	.0825/ .1125
SRF-67	lb.	.05⅝/ .07⅜
—75	lb.	.05⅞/ .07⅜
Picco 75	lb.	.105
Piccolyte resins	lb.	.19 / .225
Piccoumaron resins	lb.	.0625/ .11
Piccovars	lb.	.11 / .115
Resinex	lb.	.0275/ .0325

Solvents

Benzol, industrial	gal.	.17 / .22

Tackifiers

Bunarex 10, 25, 40	lb.	.055 / .065
Piccolyte resins	lb.	.19 / .225
Piccoumaron resins	lb.	.0625/ .11

Vulcanizing Agents

Litharge, commercial	lb.	.1375/ .1575
Eagle, sublimed	lb.	.15 / .155
National	lb.	.15 / .155
Red lead, commercial	lb.	.15 / .1725
Eagle	lb.	.16 / .165
National	lb.	.16 / .165
Sulfur, flour, commercial	100 lbs.	1.80 / 2.15
White lead silicate	lb.	.145 / .155
Eagle	lb.	.15 / .155

Trade Lists Available

The Commercial Intelligence Division of the United States Department of Commerce, Washington 25, D. C., recently compiled the following trade lists of which mimeographed copies may be obtained by American firms from this Division. The price is $1 a list for each country.

Automotive Equipment Importers and Dealers: Australia; Chile; Union of South Africa; Mexico.

Chemicals Importers and Dealers: Bolivia; Colombia; Costa Rica; Dominican Republic; Guatemala; Jamaica; Nicaragua.

Dental Supply Houses: Chile; Colombia; Venezuela.

Electrical Supplies and Equipment Imperters and Dealers: New Zealand, Union of South Africa; Switzerland; Chile; Bahamas.

Plastic Materials, Manufacturers and Molders of Plastic Products: Columbia; Union of South Africa.

Sporting Goods, Toys, and Games Importers and Dealers: Bolivia; Canada; Ecuador; Guatemala; Venezuela; Chile; Cuba; Mexico.

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

GENERAL RATES
Light face type $1.00 per line (ten words)
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Allow nine words for keyed address.

SITUATIONS WANTED RATES
Light face type 40c per line (ten words)
Bold face type 55c per line (eight words)

SITUATIONS OPEN RATES
Light face type 75c per line (ten words)
Bold face type $1.00 per line (eight words)
Replies forwarded without charge

Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

SITUATIONS OPEN

DEVELOPMENT CHEMIST, YOUNG, WITH SEVERAL YEARS' experience in rubber industry for development work on synthetic rubbers, adhesives, plastics used in fabric coatings. Excellent opportunity, Metropolitan New York Area. In reply give complete résumé and minimum salary requirements. Enclose small photo. Address Box No. 730, care of INDIA RUBBER WORLD.

WANTED: GRADUATE CHEMIST OR CHEMICAL ENGINEER for work as assistant chemist in rubber plant located in Connecticut. State in detail in first handwritten letter: age, education, experience, if any, and remuneration expected. Address Box No. 731, care of INDIA RUBBER WORLD.

OPENING FOR MECHANICAL ENGINEER QUALIFIED FOR DESIGNING A GENERAL LINE OF RUBBER AND PLASTIC WORKING MACHINERY.
National Erie Corporation
Erie, Pennsylvania

HOSE SALESMAN HAVING POTENTIAL BUSINESS FOR ANY-type handmade hose. We have new postwar latest-type equipment for manufacture. Reply giving experience and arrangement desired for salary or straight commission. Address Box No. 732, care of INDIA RUBBER WORLD.

CALENDER OPERATOR: FIRM IN NORTHERN NEW JERSEY requires experienced man for night shift. Give particulars as to experience and compensation expected. Address Box No. 733, care of INDIA RUBBER WORLD.

PLANT ENGINEER: EXPANDING PLASTICS AND RUBBER molding concern established 60 years, vicinity Trenton, N. J., offers excellent future to executive-type, college-trained engineer with 10 years' practical experience spent preferably in rubber and/or plastics. Position entails organizing and directing all plant service and maintenance facilities such as drafting, mechanical, electrical and power in a plant normally employing 600 persons. Please write fully, giving experience and salary expected. Address Box No. 734, care of INDIA RUBBER WORLD.

WANTED: *PRODUCTION SUPERVISOR* EXPERIENCED IN hard rubber compounding and molding. Must have training or experience in plant engineering and administration. Plant located on West Coast. Position offers right individual excellent opportunity. Address Box No. 735, care of INDIA RUBBER WORLD.

PRODUCTION FOREMAN TO SUPERVISE PRESS LINE AND production of small rubber plant manufacturing molded and extruded rubber products. Excellent opportunity. Plant located in Philadelphia area. State experience, salary, etc. Address Box No. 736, care of INDIA RUBBER WORLD.

EXPERIENCED REPRESENTATIVE
FOR AKRON AREA
wanted by well established crude rubber importer. All replies will be answered and held in strictest confidence. Address Box No. 726, care of INDIA RUBBER WORLD.

If you know
Rubber Sundry Sales
here's a real opportunity

We're a small rubber company with a long record of profitable operation. We're looking for a man to help us build distribution and sundry sales. The man we want is young enough to still have fight and enthusiasm; old enough to have had experience in our field. He will work closely with our general sales manager, but basically, he'll be on his own. The salary is good to start with, and better as he shows what he can do. If you know such a man, write us. Address Box No. 729, care of India RUBBER WORLD.

SITUATIONS OPEN—(Continued)

LEADING MANUFACTURER OF V-BELTS NEEDS EXPERIenced engineer with knowledge of manufacture, construction, and testing of V-belts. Job involves heading physical testing section of laboratory in addition to duties on V-belts. Unusual opportunity with progressive company for right man. In reply state age, education and business experience. Address Box No. 737, care of INDIA RUBBER WORLD.

LARGE EASTERN RUBBER MANUFACTURER NEEDS YOUNG engineer knowing mechanical rubber goods compounding and manufacturing techniques. Excellent opportunity for right man. In reply state age, education, and business experience. Address Box No. 738, care of INDIA RUBBER WORLD.

ENGINEER: AGE 25 TO 35, WITH SOME MECHANICAL GOODS production and engineering experience. This is an unusual opportunity in mechanical rubber products of a highly specialized nature. Extensive experience not absolutely necessary. Address Box No. 739, care of INDIA RUBBER WORLD.

MECHANICAL ENGINEER WANTED TO TAKE CHARGE OF engineering and maintenance departments in modern mechanical goods rubber plant located in Boston, Massachusetts. New department being established, providing good opportunity for right man. State age, education, experience, and salary asked in reply. Address Box No. 740, care of INDIA RUBBER WORLD.

WANTED: A THOROUGHLY EXPERIENCED MAN TO ORGANize and operate a very small plant manufacturing rubber heels and soles. He must be thoroughly familiar with all technical details of manufacturing rubber heels and soles. He must be thoroughly familiar with all technical details of manufacture and know where to obtain machinery and how to install it. This will be a new department of an old-established company in another line. Please give full details of experience, compensation desired, and other pertinent information. Address Box No. 741, care of INDIA RUBBER WORLD.

PROGRESSIVE AND LONG-ESTABLISHED RUBBER HEEL AND sole manufacturer requires the services of an experienced rubber chemist and compounder, some knowledge of plastics in rubber heels and soles required. Reply giving age, experience, and state salary expected. All replies will be considered confidential. Plant is located in Boston district. Address Box No. 756, care of INDIA RUBBER WORLD.

SALESMAN

to represent progressive New Jersey rubber company making mechanical rubber goods on a full-time basis. Salary commensurate with ability.

Address Box No. 728,
Care of INDIA RUBBER WORLD

PLANT SUPERINTENDENT

for a progressive rubber plant located in Central New Jersey. Give complete resumé including experience, qualifications, and salary requirements. Prefer a man between 35 and 45 years of age.

Address Box No. 727,
Care of INDIA RUBBER WORLD

(Classified Advertisements Continued on Page 589)

AEI
ASSOCIATED ENGINEERS, INC.
MANAGEMENT CONSULTANTS
JOSEPH C. LEWIS
PRESIDENT
ENGINEERING · ARCHITECTURE · ACCOUNTING
ORGANIZATION · METHODS · COSTS
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Specialists in Intricate Molding
SEMI-PNEUMATIC TIRES - ALL SIZES
All types moulded goods; motor mountings. Design and engineering service available.
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COLORS for RUBBER
Red Iron Oxides
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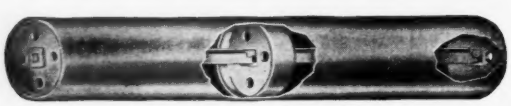
Reinforcing Fillers and Inerts
C. K. WILLIAMS & CO.
EASTON, PA.

NEW AND BETTER
GAMMETER'S
ALL STEEL ALL WELDED
CALENDER STOCK SHELL

4", 5", 6", 8", 10", 12" diameters, any length.
Besides our well known Standard and Heavy Duty Constructions, we can supply light weight drums made up to suit your needs.
THE W. F. GAMMETER COMPANY
CADIZ, OHIO

Dominion of Canada Statistics

Imports of Crude and Manufactured Rubber

	October, 1946		October, 1945	
UNMANUFACTURED	Quantity	Value	Quantity	Value
Balata ..... lbs.	13,490	$ 10,276	.....	.....
Crude rubber ..... lbs.	8,516,068	1,999,827	1,240,811	$ 474,057
Latex ..... lbs.	146,599	36,828	106,759	34,815
Rubber, powdered and waste ..... lbs.	1,573,600	34,690	641,900	14,268
Recovered ..... lbs.	1,091,800	87,636	2,332,200	169,949
Synthetic and substitute ..... lbs.	250,300	59,783	417,200	108,211
TOTALS.	11,591,857	$2,229,040	4,738,870	$ 801,300
PARTLY MANUFACTURED				
Hard rubber in rods or tubes ..... lbs.	6,211	$ 3,431	605	$ 499
Rubber thread, not covered ..... lbs.	13,760	24,395	1,330	1,199
TOTALS.	19,971	$ 27,826	1,935	$ 1,698
MANUFACTURED				
Belting	.....	$ 59,423	.....	$ 33,662
Boots and shoes of rubber, n.o.p ..... prs.	12,460	7,294	11,446	8,170
Canvas shoes with rubber soles ..... prs.	114	441	161	535
Cement	.....	39,641	.....	15,802
Clothing of waterproofed cotton or rubber.....	.....	7,615	.....	818
Druggists' sundries	.....	35,660	.....	32,963
Gaskets and washers.....	.....	30,929	.....	10,388
Gloves ..... doz. prs.	784	3,030	583	2,502
Golf balls ..... doz.	792	5,301	1	10
Heels ..... prs.	1,416	249	2,550	255
Hose	.....	42,317	.....	21,827
Hot water bottles.....	.....	4,864	.....	975
Inner tubes, n.o.p..... no.	23,126	119,604	584	1,458
Bicycle ..... no.	232	166	315	233
Liquid sealing compound...	.....	8,526	.....	6,676
Mats and matting.....	.....	81,621	.....	2,199
Nursing nipples..... gross	1,304	5,097	521	2,081
Packing	.....	11,324	.....	14,745
Raincoats ..... no.	3,660	9,441	2	32
Tire repair material.....	.....	122,497	.....	10,601
Tires, pneumatic, n.o.p.. no.	40,644	1,466,046	223	12,783
Bicycle ..... no.	2,925	3,523	479	748
Solid, for automobile and motor trucks. no.	48	927	24	1,166
Other ..... no.	.....	7,939	.....	525
Other rubber manufactures	.....	256,220	.....	137,805
TOTALS.	.....	$2,329,695	.....	$ 318,959
TOTAL RUBBER IMPORTS.	.....	$4,586,561	.....	$1,121,957

Exports of Crude and Manufactured Rubber

UNMANUFACTURED				
Crude rubber, including synthetic rubber .... lbs.	6,421,353	$1,187,568	605,716	$ 224,596
Waste rubber ..... lbs.	1,390,500	20,976	2,396,500	36,856
TOTALS.	7,811,853	$1,208,544	3,002,216	$ 261,452
PARTLY MANUFACTURED				
Soling slabs of rubber.. lbs.	8,402	$ 2,014	2,925	$ 606
MANUFACTURED				
Belting, n.o.p ..... lbs.	29,162	$ 21,420	268,571	$ 158,728
Belts, fan	.....	2,686	.....	.....
Boots and shoes of rubber, n.o.p ..... prs.	89,742	149,567	235,977	377,855
Canvas shoes with rubber soles ..... prs.	161,513	165,328	108,970	109,033
Clothing of rubber and waterproofed clothing....	.....	14,017	.....	14,362
Heels ..... prs.	134,718	9,269	222,890	16,596
Hose	.....	34,732	.....	52,472
Inner tubes for motor vehicles ..... no.	1,520	2,217	13,424	64,218
Soles ..... prs.	30,175	7,278	4,948	990
Tires, pneumatic for motor vehicles ..... no.	1,519	18,820	16,230	417,299
Other ..... no.	238	1,235	492	1,997
Wire and cable, copper, insulated	.....	10,927	.....	105,247
Other rubber manufactures	.....	20,684	.....	56,875
TOTALS.	.....	$ 458,180	.....	$1,375,672
TOTAL RUBBER EXPORTS.	.....	$1,668,738	.....	$1,637,730

"Peroxidation in Relation to Olefin Structure." E. Harold Farmer. Publication No. 71. The British Rubber Producers' Research Association, 48 Tewin Rd., Welwyn Garden City, Herts., England. 8 pages. This paper is an attempt to classify peroxides into appropriate structural groups and to relate the course of peroxidation of each group to the structure of the olefin undergoing oxidation. There is also a reconsideration of the problem of chain scission.

QUALITY **INTEGRITY** **SERVICE**
66 YEARS WITHOUT REORGANIZATION

BELTING
Transmission—Conveyor—Elevator

HOSE
for every purpose
Water—Fire—Air—Steam

PACKING
Sheet & Rod Packings
for every condition

Mechanical Specialties of Every Description
HOME RUBBER COMPANY
Factory & Main Office
TRENTON 5, N. J.
LONDON: 107 Clifton St., Finsbury CHICAGO: 168 North Clinton St. NEW YORK: 80-82 Reade St.

SITUATIONS WANTED

CHEMIST-ENGINEER: B.S. IN CH.E., 1940, GRADUATE STUDY. Over six years' experience natural rubber technology, GR-S manufacture. Experience: control, development, compounding, production, supervision, pilot plant. Desire responsible position with progressive organization. Address Box No. 744, care of INDIA RUBBER WORLD.

RUBBER CHEMIST WITH WIDE EXPERIENCE IN RUBBER, synthetics, and allied lines desires to return to sales. Interested in selling quality products for a reputable company to rubber, plastic, and allied industries. Known throughout the industry. Living in East for coverage in this important area. Address Box No. 745, care of INDIA RUBBER WORLD.

RUBBER CHEMIST AND COMPOUNDER, 19 YEARS' EXPERIence in compounding and processing mechanical goods, including rubber-to-metal bonding. 12 years' experience with all types of synthetic rubber. Now holding responsible position. Address Box No. 755, care of INDIA RUBBER WORLD.

RUBBER AND PLASTICS CHEMIST—CALENDERING VINYL film and sheeting a specialty. Thoroughly experienced compound formulation, product development, production supervision, and factory management of calendered and coated sheetings from rubber, synthetic rubber, and vinyl resins; desires responsible position N. Y. C. area. Address Box No. 757, care of INDIA RUBBER WORLD.

CHEMIST, Ph.D., 18 YEARS' EXPERIENCE HEELS, SOLES, MEchanicals, reclaiming; compounding, development, plant supervision. Reliable. Good references. Address Box No. 758, care of INDIA RUBBER WORLD.

CAN YOU USE THIS MAN? 14 YEARS' SUCCESSFUL EXperience, last eight as salesman, sales-service supervisor, and as manager of sales, advertising, and sales-promotion for national rubber manufacturer selling industry and jobbers. Record proves ability to get things done, to uncover profits, and to manage sales at low cost. Age 37, healthy, married. Yale graduate. Now living Bridgeport-New Haven area (Conn.). Go anywhere for right company as branch manager, salesman, executive, or sales manager. Address Box No. 759, care of INDIA RUBBER WORLD.

DEVELOPMENT CHEMIST-EXECUTIVE. EXPERIENCED IN development and production of soft and hard blown sponge rubber; foamed and dipped latex; rubber bonding and mechanical goods; synthetic organic chemical; plastics. Excellent collegiate training. Twenty years pursuing, directing, and coordinating research and developments and in administrative capacities. Available immediately. Address Box No. 760, care of INDIA RUBBER WORLD.

BUSINESS OPPORTUNITIES

WANTED: MANUFACTURER LOCATED WITHIN REASONABLE distance of Pittsburgh, Pa., to process on 2-roll rubber mill, material to be furnished by us. Address Box No. 742, care of INDIA RUBBER WORLD.

RUBBER MANUFACTURER IN ENGLAND WISHES TO PURchase special designs of rubber articles or patented specialties with a view to European manufacture and distribution. Address Box No. 743, care of INDIA RUBBER WORLD.

MACHINERY AND SUPPLIES WANTED

WANTED: 2—60" RUBBER MILLS, COMPLETE. ADDRESS BOX No. 748, care of INDIA RUBBER WORLD.

WANTED: USED RUBBER BALE CUTTER, ANY MAKE. STATE price and details. Address Box No. 749, care of INDIA RUBBER WORLD.

WANTED: RUBBER CUTTER, HYDRAULIC GUILLOTINE type, capable of cutting bale rubber. Address Box No. 751, care of INDIA RUBBER WORLD.

WANTED: USED PRECO PRESSES, ELECTRICALLY HEATED Platens. Give full information, condition, price, and location in first letter to VERNAY LABORATORIES, INC., Yellow Springs, Ohio.

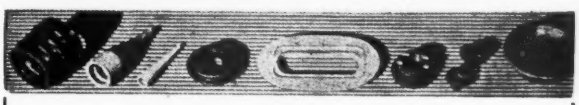
Roller Coverings

Wanted to contact manufacturers who could undertake covering rollers from ten to eighty inches long. . .

Please send samples giving the tolerance of dimensions desired and samples of present productions . . . Also rate of delivery per week.

Write to
Box 183, Realservice Advtg.
110 West 34th St., N.Y. 1, N.Y.

GRANULATED CORK
FOR EXTENDING RUBBER
SOUTHLAND CORK COMPANY
P. O. BOX 868 NORFOLK, VA.



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BLOWN — SOLID — SPONGE
FROM NATURAL, RECLAIMED, AND SYNTHETIC RUBBER
THE BARR RUBBER PRODUCTS CO. SANDUSKY OHIO

(*Classified Advertisements Continued on Page* 590)

We are principals acting in our own behalf willing to

PAY YOU IMMEDIATE CASH

For ASSETS or CAPITAL STOCK of . . .

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All transactions held in strictest confidence. Personnel retained wherever possible.

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Producer in Mexico of

GUAYULE RUBBER

Washed — AMPAR BRAND — Dried

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Complete plant engineering service for increased efficiency. New plants, alterations, modernization, automatic machine design, for the rubber industry. Ask for references.

313-14-15 Everett Bldg. Akron 8, Ohio

HOWE MACHINERY CO., INC.

30 GREGORY AVENUE PASSAIC, N. J.

Designers and Builders of

"V" BELT MANUFACTURING EQUIPMENT

Cord Latexing, Expanding Mandrels, Automatic Cutting, Skiving, Flipping and Roll Drive Wrapping Machines.

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All Rubber Manufacturers Get Our Offerings Regularly. They need such units as

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EXTRUDERS VULCANIZERS
HYDRAULIC PRESSES

For Quicker Action and Better Price
Send Full Details and YOUR Price to

EQUIPMENT FINDERS BUREAU

6 Hubert Street New York 13, N. Y.

MACHINERY AND SUPPLIES WANTED—(Continued)

WANTED: #9 BANBURY MIXER, FIRST-CLASS CONDITION, complete. 1—60″ or 84″ Mill, first-class condition, complete. Write complete details and price. Address Box No. 750, care of INDIA RUBBER WORLD.

ONE No. 9 BANBURY MIXER IN GOOD CONDITION. ADDRESS Box No. 752, care of INDIA RUBBER WORLD.

WANTED: 1 CAMERON CUTTING MACHINE MODEL 4-D CAMACHINE #26, 50″ preferred. Address Box No. 753, care of INDIA RUBBER WORLD.

RUBBER MILL WANTED, 36 TO 60 INCHES. FIRST-CLASS condition only. Write complete details and price. Address Box No. 754, care of INDIA RUBBER WORLD.

MACHINERY AND SUPPLIES FOR SALE

FOR SALE: 1—#3 NATIONAL ERIE TUBER WITH DRIVE AND variable speed, D.C. motor. 1—48 x 48″ four-opening Hydraulic Press. 1—20″ x 22″ x 60″ Rubber Mill. 1—9 x 40′ High-Pressure Vulcanizer with quick-opening door. 1—French Hydro-pneumatic Accumulator. 100-gallon and 250-gallon Baker Perkins Heavy-Duty, Jacketed Mixers, Miscellaneous Hydraulic Presses, Pumps, Calenders, Tubers, etc. CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, New York 7, N. Y.

BERLOW AND SCHLOSSER CO.

Consultation and Technical Service
Paper, Textile and Wringer Rolls—Mechanicals
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RALPH B. SYMONS

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BROCKTON TOOL COMPANY

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OUR NEW MACHINERY
HYDRAULIC PRESSES
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BRAKES—LIFT TABLES
MILLS—MIXERS
SUSAN GRINDERS

NEW MACHINERY REBUILT

OUR 5-POINT REBUILDING PROCESS
1—INSPECTION
2—DISASSEMBLY
3—REBUILDING
4—MODERNIZING
5—GUARANTEE

L. ALBERT & SON
COAST-TO-COAST
TRENTON, N. J.—MAIN OFFICE

MACHINERY AND SUPPLIES FOR SALE—(Continued)

FOR SALE: FARREL 6″ x 13″, 10″ x 20″, 14″ x 30″, AND 16″ x 48″ 2-Roll Rubber Mills; 400-ton Hydraulic Extrusion Press; Hydraulic Presses from 12″ x 12″ to 42″ x 48″ Platens, from 50 to 500 tons; Hydraulic Pumps and Accumulators; Mixers, Grinders, etc.
WE BUY YOUR SURPLUS MACHINERY
STEIN EQUIPMENT CO.
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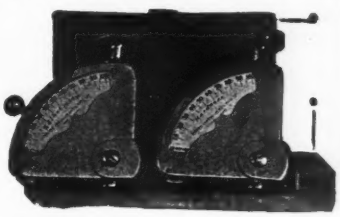

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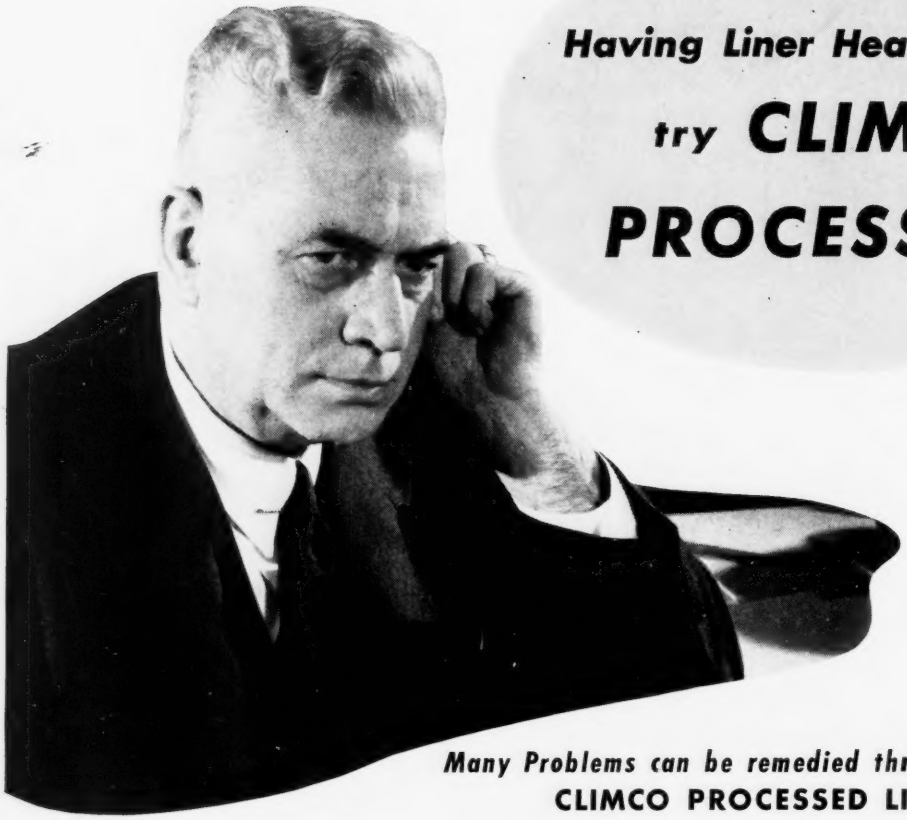

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